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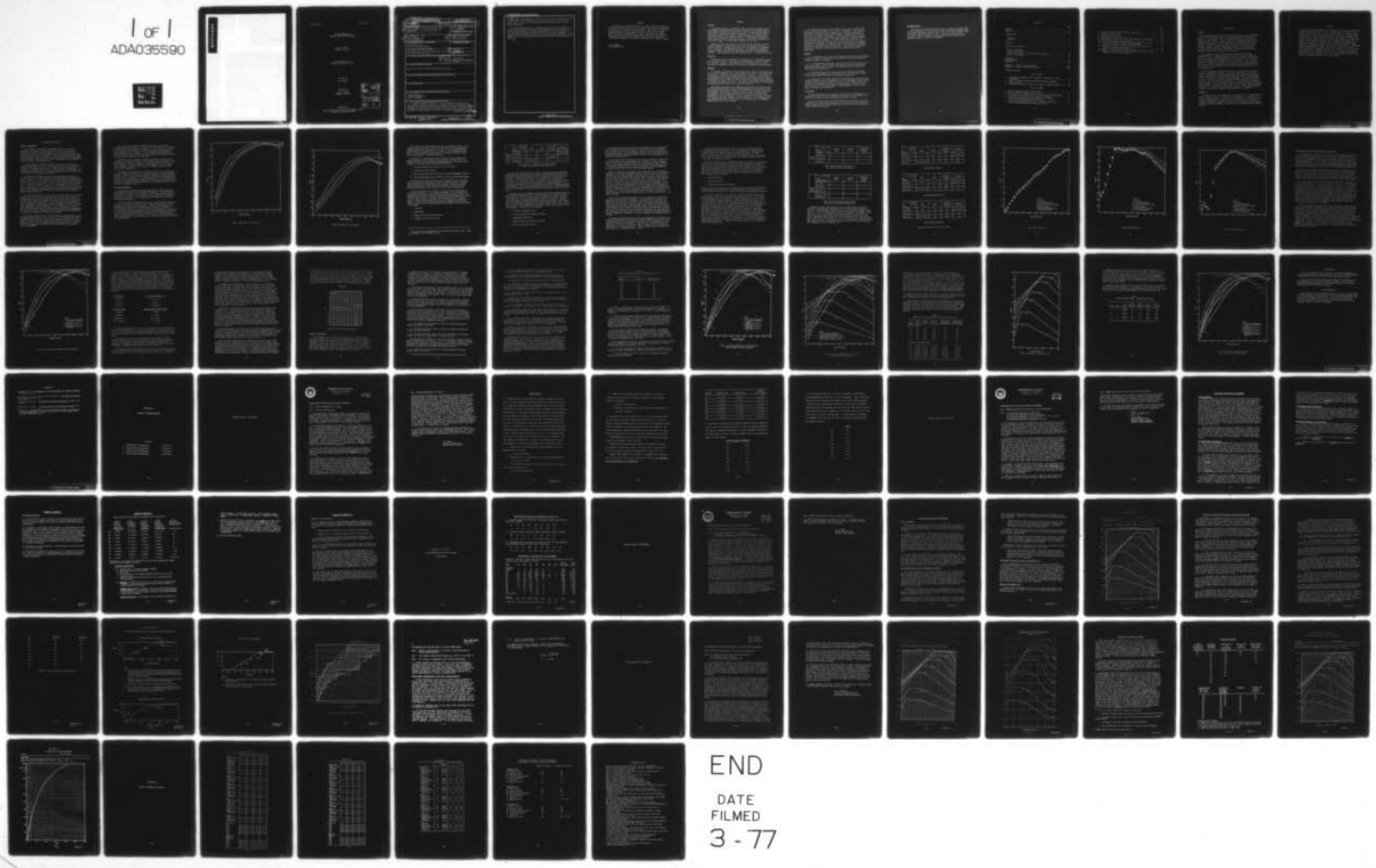

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UTILITY THEORY IN MILITARY PERSONNEL MANAGEMENT

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An important element of personnel policy testing and decision making with computer simulation models is the criteria used for evaluating changes. Measures of cost and inventory have been used by the Bureau of Naval Personnel to manage the distribution of personnel filling the billet structure. Other measures are needed, however, to achieve an optimum distribution of strength

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Thus, an effort was undertaken to develop another personnel planning tool--a utility model. This model would assess the overall value that the Navy should expect to receive from the personnel afforded by a level of manpower expenditure.

Two Delphi experiments and a Broadcast experiment were conducted to solicit the opinions of Navy experts from headquarters as well as the fleet regarding productivity of an average enlisted man in terms of utility to the Navy as he progressed in years of service in a specific paygrade. Paygrade utility "tents" from the Delphi experiments were developed. Results showed that in all paygrades maximum utility is reached well before end of career.

FOREWORD

This study was jointly sponsored by the Navy Personnel Research and Development Center and the Office of Naval Research, and was conducted in support of the Bureau of Naval Personnel. The vehicle for this work was provided by the Office of Naval Research under contract number N00014-72-C-0526. Acknowledgement is due to Mr. Robert H. Lehto, Special Assistant, Enlisted Force Analysis, Bureau of Naval Personnel (Pers-2X), who fathered the concept of applying utility measures to personnel planning. The Technical Monitor was Mr. Thomas A. Blanco.

J. J. CLARKIN
Commanding Officer

SUMMARY

Problem

An important element of personnel policy testing and decision making with computer simulation models is the criteria for evaluating changes. The ultimate criterion is the "goodness of fit" of the enlisted personnel inventory to established personnel requirements within other external constraints such as end strength, man-year average, and control dollars. Within these constraints, however, there is a considerable latitude for discretionary action for the decision maker, especially on decisions affecting the length of service (LOS) dimension of the force.

Measures of cost and inventory have been used by the Bureau of Naval Personnel (BUPERS) to manage the distribution of personnel filling the billet structure. However, measures of cost and inventory by themselves are not sufficient for personnel planning. An optimum distribution of strength cannot be achieved by simply minimizing cost while maximizing inventory. Other measures must be identified, such as a measure of utility.

Objective

The objective was to determine the productivity of an average enlisted man in terms of utility to the Navy as he progressed in years of service in a specific paygrade. The results are to be incorporated in a force *distribution optimization* model to be used by the Bureau of Naval Personnel.

Approach

An important prerequisite for developing such a model is a measure which can be used to quantify, over a useful range, the value of the average Navy enlisted man. Lacking an available source for a measure of this kind, it was determined that the only practical source from which a measure might be constructed were Navy experts--those who have had an opportunity to monitor the progress of the enlisted man and to observe the change in his usefulness to the Navy throughout his career. These are the only experts whose opinions and observations are likely to be valid and credible.

Two Delphi experiments and a Broadcast experiment were conducted which solicited opinions of Navy experts from headquarters as well as the Fleet. These experts were asked to estimate (1) the value a man has at entry into the paygrade, (2) the year of service where he reaches maximum value in his paygrade, (3) the length of service during which he maintains his maximum value, and (4) the value he has at the end of his career, assuming he remains in the same paygrade. Utility estimates of the average man in each paygrade relative to the utility of the average man in the highest paygrade (E-9) were also obtained.

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Two panels of experts, a senior officer and a junior officer panel, were selected within BUPERS for the Delphi I experiment. The Broadcast experiment solicited utility estimates from a different population of Navy experts (including senior enlisted men) to validate and refine the results of the Delphi I experiment. A one-shot questionnaire was used this time rather than the iterative Delphi procedure. Length of service was divided into four classes: (1) first term, (2) second term, (3) careerist with less than 20 years, and (4) careerist with 20 to 30 years. Estimates were obtained for annual base pay, bonus pay, and achievement. The Delphi II experiment was addressed only to three panels of personnel serving in operational billets in the Fleet. Seventy-five officers and enlisted men serving in the Second Fleet participated in the third experiment.

Results

a. In describing the utility of the average enlisted man as he advanced in years of service, little statistical difference was found among skill groupings (Delphi I experiment).

b. In the Broadcast experiment, one proxy for utility, base pay, was found to be biased. Utility curves constructed from the base pay proxy were found to be linearly related to an analogous table of values constructed from actual base pay.

c. Two other proxies for utility used in the Broadcast experiment, bonus pay and achievement, both produced utility curves similar to that of the utility curves developed in the Delphi experiments.

d. Results of both Delphi experiments showed that the average enlisted progressor reaches a point of maximum utility at approximately 24-27 years of service and thereafter declines in utility. This general pattern also applies to the average enlisted man at each paygrade. Those who do not get promoted (i.e., those who remain in grade) decline in value to the Navy at advanced years of service.

Conclusions

From the consistency of the results in both Delphi experiments, it can be concluded that the Delphi technique seems to be a valid technique to measure the utility of the enlisted man by paygrade and LOS.

Since an enlisted man's usefulness decreases if he remains in the same paygrade (i.e., does not get promoted) after a period of time, the Navy could possibly benefit by employing "early out" policies for enlisted men with no chance of promotion.

Recommendations

The results of this study should be used to develop a utility model to help the Bureau of Naval Personnel define long-range management goals for the Navy Personnel enlisted force. The utility model could be used along with other models such as cost, inventory, and reenlistment elasticity models to optimize personnel force distributions by skill grouping, length of service, and paygrade.

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INTRODUCTION

Problem

An important element of personnel policy testing and decision making with computer simulation models is the criteria used for evaluating changes. One criterion, cost, is provided through the use of the Per Capita Cost Model (Dept. of Navy, 1972). The ultimate criterion is the "goodness of fit" of the enlisted personnel inventory to established personnel requirements, within other external constraints such as end strength, man-year average, and control dollars. Within these constraints, however, there is considerable latitude for discretionary action for the decision maker, especially on decisions affecting the length of service (LOS) dimension of the force.

An Enlisted Personnel Planning System (ADSTAP) was developed (Silverman, 1971) to manage the distribution of personnel filling the billet structure. ADSTAP encompasses a series of models for projecting the personnel inventory distribution of the enlisted force, and the Per Capita Cost Model for computing the associated costs. Each of these models can be exercised against various recruitment, reenlistment, and retirement options, thus enabling an assessment of alternative policies with regard to their impact on the inventory distribution and costs of the enlisted force.

However, measures of cost and inventory, by themselves, are not sufficient for personnel planning. An optimum distribution of strength cannot be achieved by simply minimizing cost while maximizing inventory. An additional measure is needed to determine the value of a man working a job. In industry, the value may be determined by the prevailing wage for that job. In the military, however, no direct control is exercised over what is paid to the Navy enlisted man. Therefore, what the military pays for labor is not necessarily a measure of the value that is attributed to that labor. Certainly, the pay scale is not irrational--the Navy must believe an E-7 is worth more than an E-1 because of the higher pay an E-7 receives. The question remains, "How much more is he worth?"

Objective

The objective was to determine the productivity of an average enlisted man in terms of utility to the Navy as he progresses in a specific pay-grade in years of service. The utility results are to be used in an overall force distribution optimization model. This model would enable the personnel planner to assess the overall value that the Navy should expect to receive from the personnel inventory that the manpower dollars expended afford.

APPROACH

An important prerequisite for developing a utility model is a measure which can be used to quantify, over a useful range, the value of the average Navy enlisted man. It was determined that the opinions of Navy experts were the only practical source from which such a measure might be constructed. Since these men have had an opportunity to monitor the progress of the enlisted man and to observe the change in his usefulness to the Navy throughout his career, their opinions and observations are likely to be valid and credible. Thus, two Delphi experiments and a Broadcast experiment were performed to solicit the opinions of these experts in a procedural attempt to develop the value measure. The Delphi methodology developed at Rand Corporation was generally followed. In all experiments, the experts were asked to estimate (1) the value a man has at entry into a paygrade, (2) the year of service when he reaches maximum value in a paygrade, (3) the length of service during which he maintains his maximum value, and (4) the value he has at the end of his career, assuming he remains in the same paygrade.

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DISCUSSION AND RESULTS

Delphi I Experiment

In the Delphi I experiment (B-K Dynamics, 1973), two panels of experts--one comprised of senior officers, and the other, junior officers--were selected within BUPERS. All of these officers had completed operational fleet assignments within the last year and a half. The senior officer panel consisted of former COs and XOs, and the junior officer panel, of officers who had previously been division officers and department heads. Throughout the Delphi I experiment, the responses of these two panels were kept separate.

The questionnaire developed for administration to the selected panelists explained the utility concept and solicited each participant's estimates of personnel utility in two formats--graphic and tabular. Further, each participant was asked to make two sets of estimates: one considering the "hard" skill or technical enlisted man and the other the "soft" skill or nontechnical enlisted man.

To complete the graphical format, each participant was asked to describe the utility of the average Navy enlisted man as he advanced in years of service. The participant was directed to sketch this observed change in value on a scale ranging from 0 to 100 over the years of service of an average Navy enlisted man. The restrictions placed on his sketch were: (1) the curve should begin at 0, 0 (interpreted as 0 value at 0 years in service), and (2) at some point in time from the years 1 through 30, it should reach a maximum excursion of 100, which would indicate the point in the career of the average Navy enlisted man when he reaches maximum value to the Navy.

To complete the tabular format, the participant was directed to supply estimates of usefulness for each paygrade. In other words, he was to estimate the value of the average Navy enlisted man in each grade (E-1 through E-9), regardless of length of service in that grade, relative to all the grades, on a scale from 0 to 100. Further, participants were asked to identify any materials or information which could assist them in their assessment. This information was to be supplied, if possible, by those administering the questionnaire. Upon completion and return of the first-round questionnaires, the individual estimates were aggregated by panel and by skill. The mean utility estimates and the interquartile statistics were computed, plotted, and tabulated.

Second-round questionnaires for each panel were then prepared, incorporating these statistics. In this round, the participants were asked to reappraise their estimates, based on the aggregate statistics for the panel in which they served, and to simply resketch their own estimates of personnel utility over the aggregate graphical presentation. They were also asked to supply the rationale they had employed in making their utility assessments.

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Upon return of the second-round questionnaires, the aggregate statistics again were prepared. Further, an edited summary of rationale provided by the panel members was prepared. These statistics and summary rationale were incorporated into the third-round questionnaires and distributed to the panelists. The participants were directed to again reappraise their estimates and to respond to the summary rationale indicating their agreement or disagreement.

Analysis of the third-round statistics disclosed considerable convergence in the panel estimates, as illustrated in the narrowness of the interquartile statistics. Because of this convergence, and the fact that a number of the panel members had left BUPERS, it was determined that no greater refinement of the utility estimates from this first experiment was necessary.

Two significant results were determined in analysis of the returns. First, a statistical difference was found between the estimates aggregated by panel. Junior officers placed a greater emphasis on experience than senior officers. Second, little statistical difference was found between the panel estimates aggregated by skill grouping. As a consequence, for further use, the estimates were aggregated by dropping the differentiation by skill. The means and interquartiles of the resultant utility curves are shown in Figures 1 and 2.

Broadcast Experiment

The purpose of the Broadcast experiment was to validate and refine, if possible, the results of the Delphi I experiment. The methodology employed was to solicit utility estimates in a different manner and from a different population of Navy Experts, and to analyze these resultant estimates for consistency and comparability both within the experiment and between experiments.

The first major difference between the two experiments was the means used to select utility estimates. In contrast to the iterative Delphi procedure used in the first experiment, a one-shot questionnaire was developed and administered to several distinct groups of experts. It was recognized that this procedure would not yield aggregate results with the same narrow dispersion observed in the iterative procedure. However, it was believed that the mean value estimates of the larger sample of experts available with the simpler one-shot procedure would be sufficient for testing consistency and comparability. Both pilot and validation tests were administered.

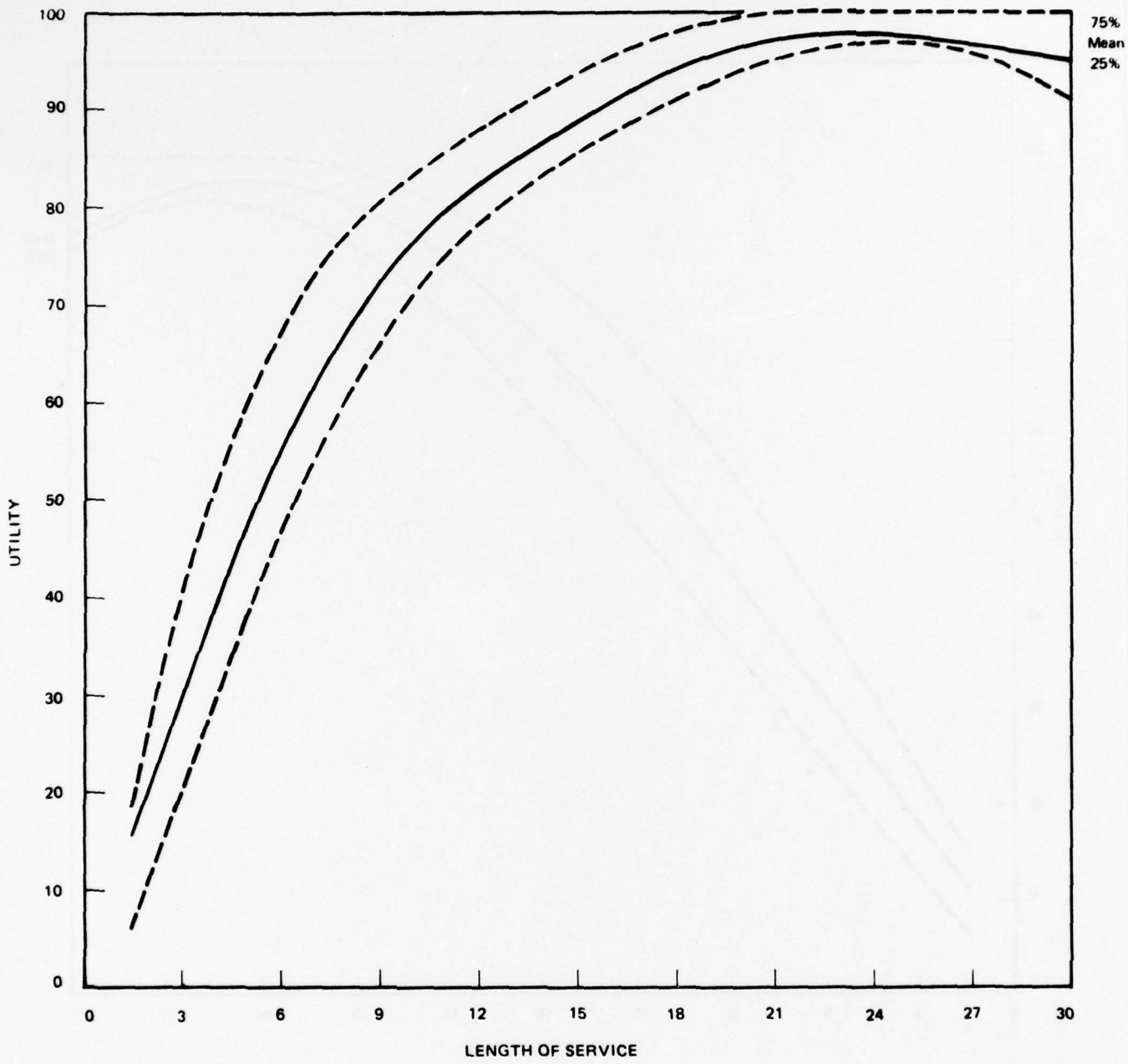

Figure 1. Utility estimates – senior officer panel.

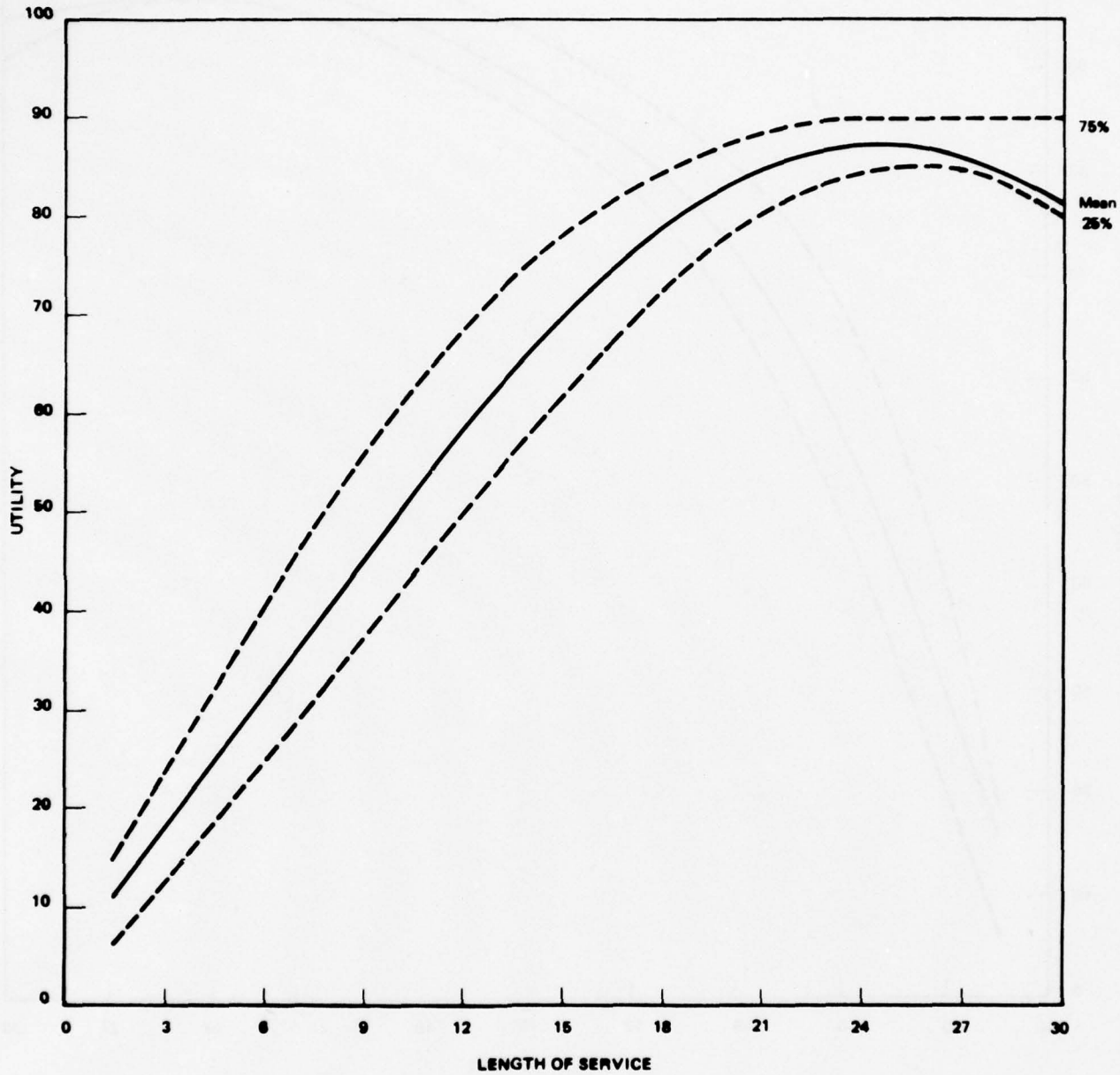

Figure 2. Utility estimates – junior officer panel.

The second major difference was the unit of measure in which utility estimates were solicited. In the first experiment, participants used a nondimensional scale ranging from 0 to 100. In the second experiment, three proxies for utility--base pay, bonus pay, and achievement--were used.[1] It was thought that participants would find it easier to deal with such measures in a one-shot exercise.

The third major difference was that estimates were obtained from a wider population of Navy experts, including senior enlisted men. To accomplish this, the questionnaire was administered to four Navy panels, comprised of personnel from the following activities:

1. Training Publications Group (E-7's, E-8's, E-9's)

2. Examination Center (E-9's)

3. Naval Postgraduate School (Student Officers)--Management Science

4. Naval Postgraduate School (Student Officers)--Operations Research

The first proxy measure included in the questionnaire was base pay. Each participant was directed to construct a base pay table, recording dollar values which corresponded to his judgment of what the average enlisted man should be paid. The pay table was to reflect what the participant perceives to be the value of the average enlisted man.

The matrix illustrated in Figure 3 was used by the participants to record their estimates. In the first experiment, it was observed that participants experienced some difficulty in estimating the utility of an enlisted man by length of service. This difficulty apparently was due to the fact that there is no readily available measures of the value of length of service whereas the grade of an enlisted man is an apparent measure. Because of this built-in difficulty, length of service as a factor for use in the second experiment was subdivided into the following four classes:

1. First Term

2. Second Term

3. Careerist with less than 20 years

4. Careerist with 20 to 30 years

---

[1]Only base pay and achievement were included in the pilot test. Bonus pay was added to the validation test.

	Experience Grouping / Rate Grouping	1st Termer	2nd Termer	Careerist (Up thru 20 Years)	Careerist (20-30 Years)
Overall Navy Enlisted Men	Apprentice				
	Journeyman			$10,000	
	Supervisor				

Figure 3. Matrix used for estimating what the average enlisted man should be paid in comparison to the careerist journeyman.

By the same rationale, the pay grade of the average enlisted man was aggregated into three categories. Rather than estimating the utility of an average enlisted man differentiated by paygrade, each participant was requested to estimate the utility of an enlisted man differentiated by the type of job he is performing--i.e., whether he is an apprentice, a journeyman, or a supervisor. For this purpose, the journeyman was defined to be the enlisted man who actually performs the "hands-on-labor." In aggregating the results of this experiment using existing paygrade population statistics, the following equivalencies were used: apprentices--E-3's and E-4's; journeymen--E-5's and E-6's; and supervisors--E-7's, E-8's and E-9's.

The base pay of a journeyman with less than 20 years experience was set arbitrarily at $10,000 per year. The participants were asked to accept this figure and to record their base pay estimates for each of the other classifications of rate and experience relative to this preset figure. Each participant was asked to construct two base pay tables. The first was to be constructed considering the average enlisted man in the overall Navy, and the second, considering the average enlisted man in one of five rating groups. Participants were to select a rating group, based on their own experience, from one of the following:

1. Electronic Equipment Repair
2. Electrical/Mechanical Equipment Repair
3. Seamanship Specialists
4. Administrative Specialists and Clerks
5. Service and Supply Handlers

The results from both the pilot and validation tests of the questionnaire showed that the base pay tables constructed by the participants were linearly related to the analogous table of values constructed from the actual base pay. The participants' tables also reflected actual pay differentials between rates and years of service, thus accounting for the constant of proportionality.

To analyze the data obtained from the base pay question, figures from the tables submitted by participants were converted to a scale ranging from 0 to 100. The individual tables were then aggregated and averaged to construct summary tables of values by panel and by rating group. All of the tables developed from the base pay estimates, whether aggregated by panel, rating group, or both, were strikingly similar.

When the base pay utility tables were transformed into LOS-dependent estimates (by computing a weighted average utility at each year of service according to the actual strength distribution at each year of service), the resultant curve showed nearly linear growth in utility from the point of entry into the Navy up to the 30-year point. Because of this finding, there was some concern as to whether base pay was a biased proxy for utility. There are a number of explanations for this phenomenon. First, since participants know generally what enlisted men are actually paid as they advance in rate and experience, this idea might have overwhelmed any different notion that they may have had regarding what enlisted men should be paid. On the other hand, participants may believe that the military is receiving full value from each manpower dollar expended, and that the actual base pay of the average enlisted man is, in fact, proportional to the utility derived.

In an effort to avoid this apparent bias, a "bonus pay" question was included in the validation experiment. To complete this question, the participant was directed to construct a bonus pay table, using the same format as that used for the base pay table, with the exception that no values were pre-recorded. The participant was directed to decide when the average enlisted man reaches his greatest value to the Navy and to record in the table a value of $100 for the appropriate experience-rate groupings. The rest of the table was to be completed by recording the bonus pay that the average Navy enlisted man in the other experience-rate groups should be paid in comparison to the group to which he assigned the maximum bonus pay of $100.

The bonus pay estimates were analyzed and aggregated in the same way as the base pay estimates. The resultant summary tables, however, were quite different from the base pay summary tables, and the LOS-dependent utility curves did not show the linearity. More important, the general shape of these bonus pay utility curves were similar to that of the utility curves developed in the Delphi experiment. These findings support the assertion that base pay is a biased proxy for utility.

It should be noted that "bonus pay" was defined in the questionnaire as entirely separate and distinct from any existing pay supplements such as proficiency pay, hazard duty pay, or reenlistment pay. Although this distinction was made, many of the participants made clear, in their written comments and in conversation with those administering the questionnaire, their opposition to the proficiency pay system, in particular, and to any bonus pay system in general.

The third proxy for value, achievement, was incorporated in the questionnaire to solicit opinions regarding the possible relationship between the overall value of the individual to the Navy and the degree to which he possesses the attributes which contribute to that overall value. In development of this question, it was assumed that the value of an average Navy enlisted man changes in some orderly fashion as he advances in length of service and rate, and that this may be due to changes in his exercise of the following three attributes:

1. Military Ability

2. Leadership Ability

3. Professional/Vocational Ability

Commonly accepted definitions of leadership ability and professional ability were supplied to the participants. Military ability was defined as "the ability of the enlisted man to respond to command in an emergency situation."

To solicit achievement estimates from the participants, two questions were developed. The first dealt with the importance of each of the three attributes selected to successful performance. The matrix used to record these estimates is shown in Figure 4. The participant was asked to record a value of 100 to identify what he considered to be the most important attribute and to record for the remaining two attributes a value corresponding to his estimates of their relative importance. The second question directed the participant to estimate the achievement of each of these attributes by the average Navy enlisted man as he gained in experience. The matrix in Figure 5 was used to record these estimates. The participant was directed to record a value of 100 to identify the experience group in which he considered the average Navy enlisted man reaches maximum achievement of the attribute and to record, for each of the other experience groups, values which correspond to his estimates of the reduced achievement. Processing and analysis of these two tabulations were directed toward mapping these measures into a composite achievement measure as a function of both rate and experience.

	Attributes / Rate Grouping	Military Ability	Leadership Ability	Professional/ Vocational Ability
Overall Navy	Apprentice			
	Journeyman			
	Supervisor			

Figure 4. Matrix for estimating relative importance of selected attributes to successful job performance.

	Attributes / Experience Grouping	Military Ability	Leadership Ability	Professional/ Vocational Ability
Overall Navy Enlisted	1st Termer			
	2nd Termer			
	Careerist – Less than 20 years			
	Careerist – More than 20 years			

Figure 5. Matrix for estimating achievement of selected attributes by the average enlisted man during his career.

Aggregate utility tables derived from the three proxies--base pay, bonus pay, and achievement estimates for the overall Navy--are shown in Figure 6. LOS-dependent utility estimates derived from the summary tables for each of the five rating groups are shown in Figures 7 through 9. From Figure 7, it can be seen that the base pay estimates obtained from the second experiment again conform with the existing base pay table. The curves show nearly linear growth in utility from the start of the enlisted man's career to the end at year 30. Thus, it is apparent that this question inherently involves a considerable amount of bias as to what the base pay is as opposed to what it "should" be.

Rate Grouping \ Experience Grouping	1st Termer	2nd Termer	Careerist (Up thru 20 Years)	Careerist (20-30 Years)
Apprentice	7	14	15	
Journeyman	22	36	52	62
Supervisor		55	80	100

Base Pay Utility Estimates

Rate Grouping \ Experience Grouping	1st Termer	2nd Termer	Careerist (Up thru 20 Years)	Careerist (20-30 Years)
Apprentice	30	79	91	
Journeyman	2	77	100	84
Supervisor		70	100	87

Achievement Utility Estimates

Rate Grouping \ Experience Grouping	1st Termer	2nd Termer	Careerist (Up thru 20 Years)	Careerist (20-30 Years)
Apprentice	24	23	13	
Journeyman	52	87	81	51
Supervisor		85	100	78

Bonus Pay Utility Estimates

Figure 6. Tabular results from the Broadcast experiment.

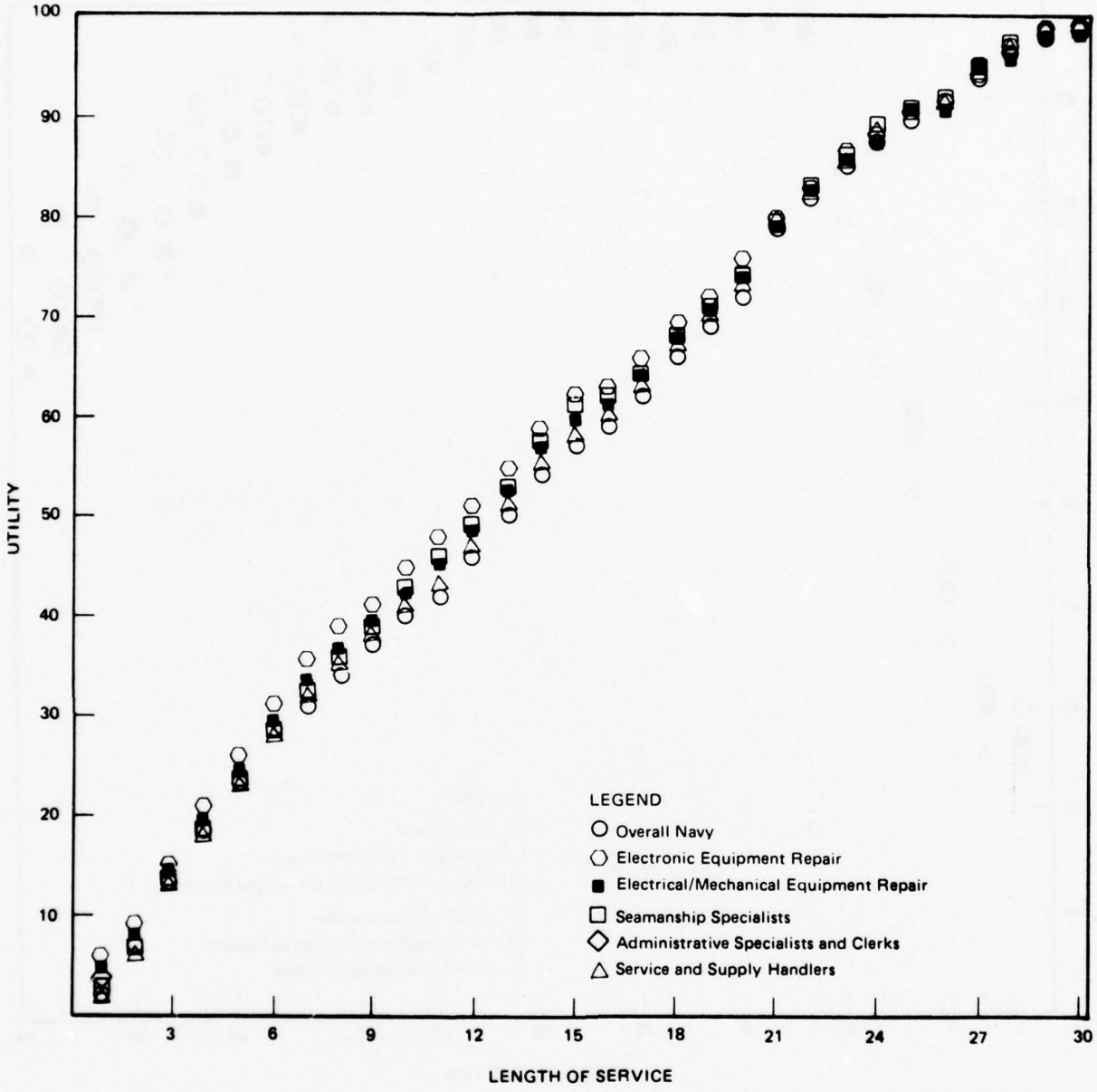

Figure 7. Base pay utility curve.

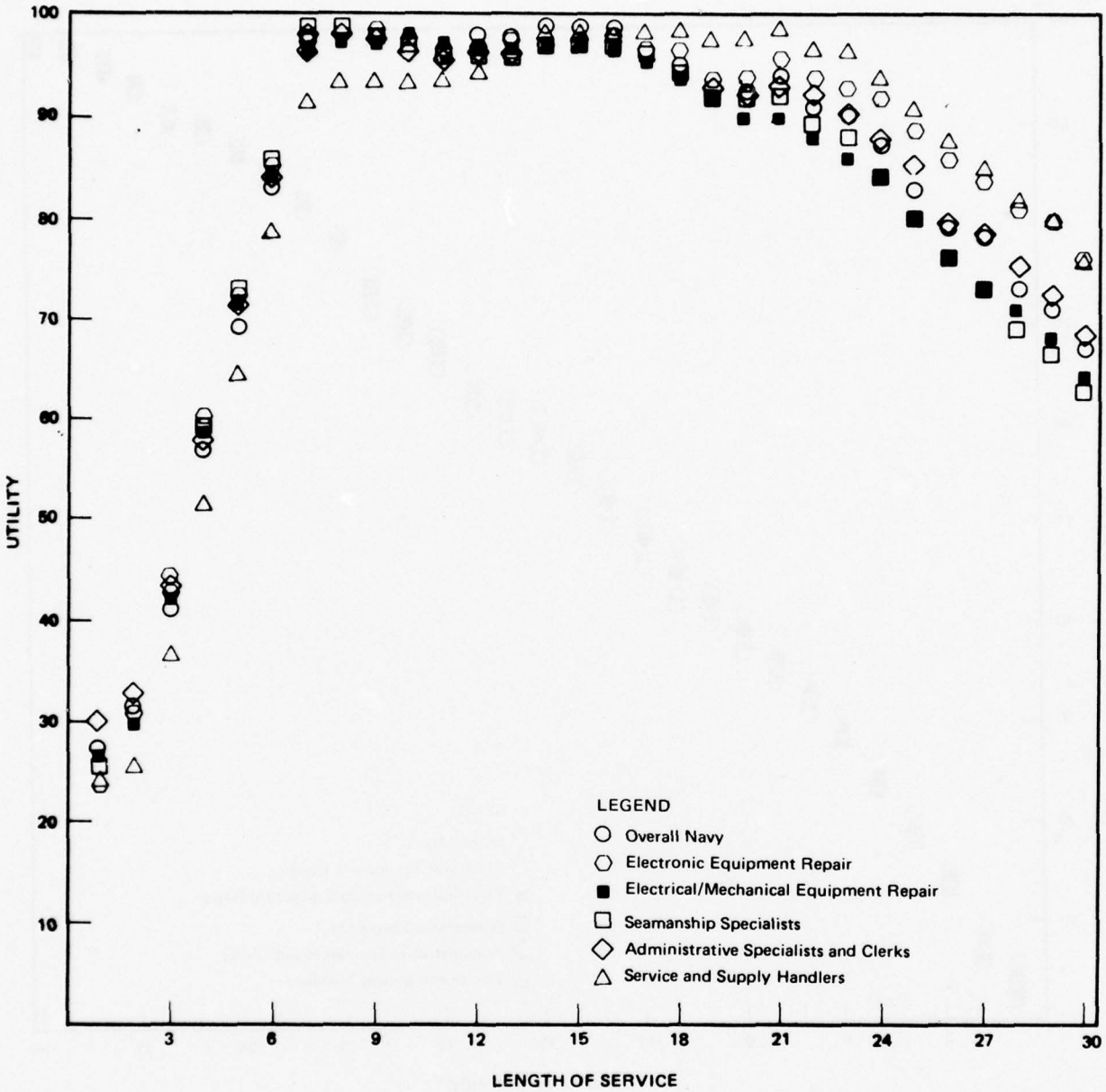

Figure 8. Bonus pay utility curve.

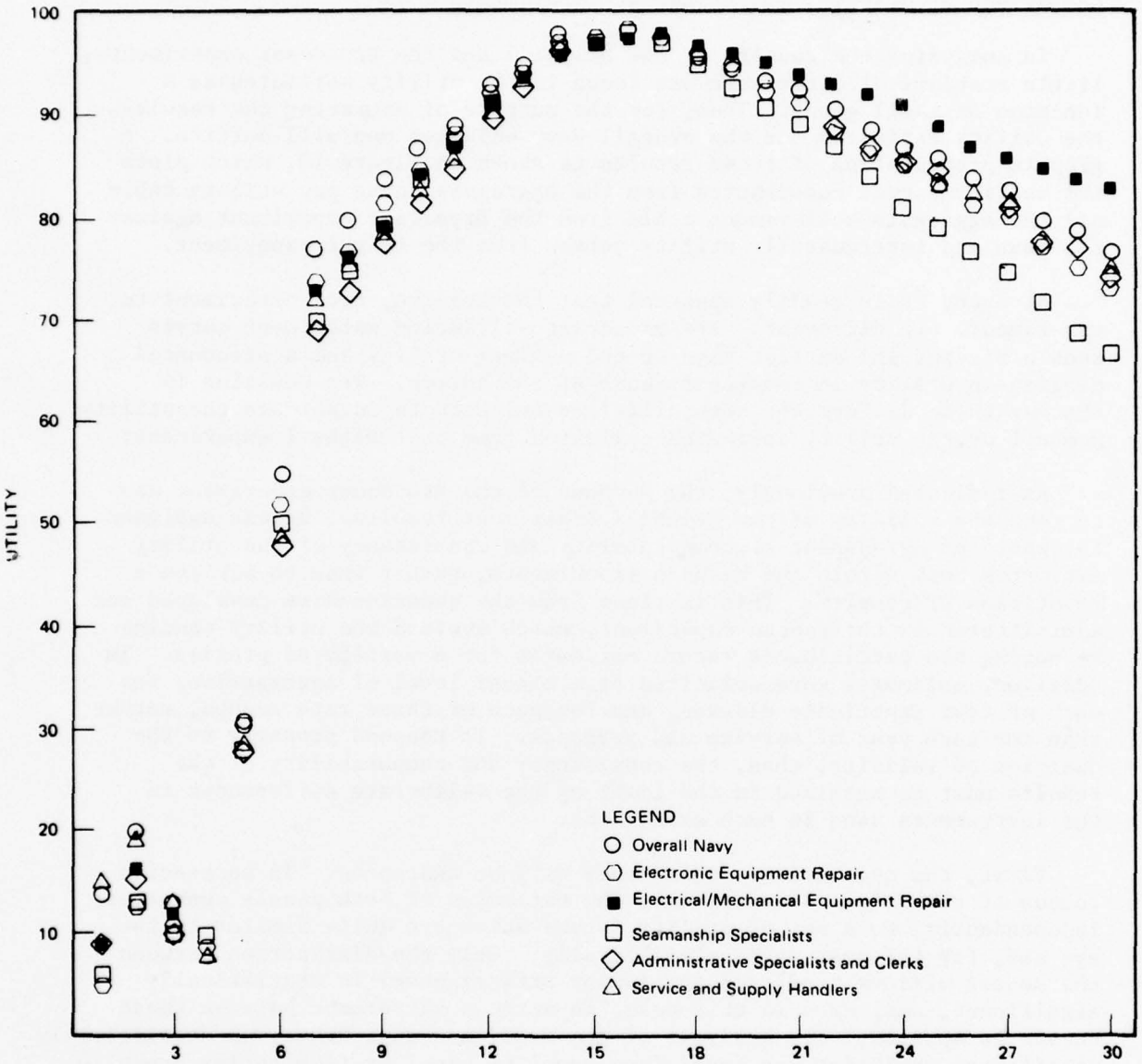

Figure 9. Achievement utility curve.

Comparison of Delphi I and Broadcast Experiments

In analyzing the results of the Delphi I and the Broadcast experiments, little statistical difference was found in the utility estimates as a function of skill group. Thus, for the purpose of comparing the results, the utility estimates for the overall Navy enlisted man will suffice. A graphic presentation of these results is shown in Figure 10, which plots the utility curves constructed from the aggregate bonus pay utility table and the aggregate achievement table from the Broadcast experiment against the mean and interquartile utility curves from the Delphi experiment.

At once, it is readily apparent that the results, from experiment to experiment, are different. The Broadcast validation experiment curves show a steeper and earlier rise to the maximum utility and a pronounced decline in utility in the later years of the career. The question is whether these differences are sufficient evidence to invalidate the utility concept or the utility estimates collected from the Delphi I experiment.

As indicated previously, the purpose of the Broadcast experiment was to test the validity of the Delphi I experiment results. It was designed to enable an assessment of comparability and consistency of the utility estimates both within and between experiments, rather than to achieve a repetition of results. This is clear from the questionnaire developed and administered in the second experiment, which avoided the utility concept by having the participants record estimates for a variety of proxies. In addition, estimates were solicited at a higher level of aggregation, for each of four experience classes, and for each of three rate groups, rather than for each year of service and paygrade. To respond properly to the question of validity, then, the consistency and comparability of the results must be examined in the light of the deliberate differences in the instruments used in each experiment.

First, the question of consistency will be addressed. In successive rounds of the Delphi I experiment, the estimates of both panels converged, independently, to a set of utility curves which are quite similar to the eye and, for the most part, statistically. Only the distinction between the senior officer panel and the junior officer panel is statistically significant, and, even in this case, no serious difference between these curves is apparent. In analysis of the Broadcast experiment, no statistically significant variation was found from panel to panel or from rating group to rating group. Only the variation due to the base pay question is statistically significant. Further, the summary utility curves developed from two independent estimates in each experiment have the same general shape. Within reasonable limits, the criteria for consistency are satisfied over most of the career length.

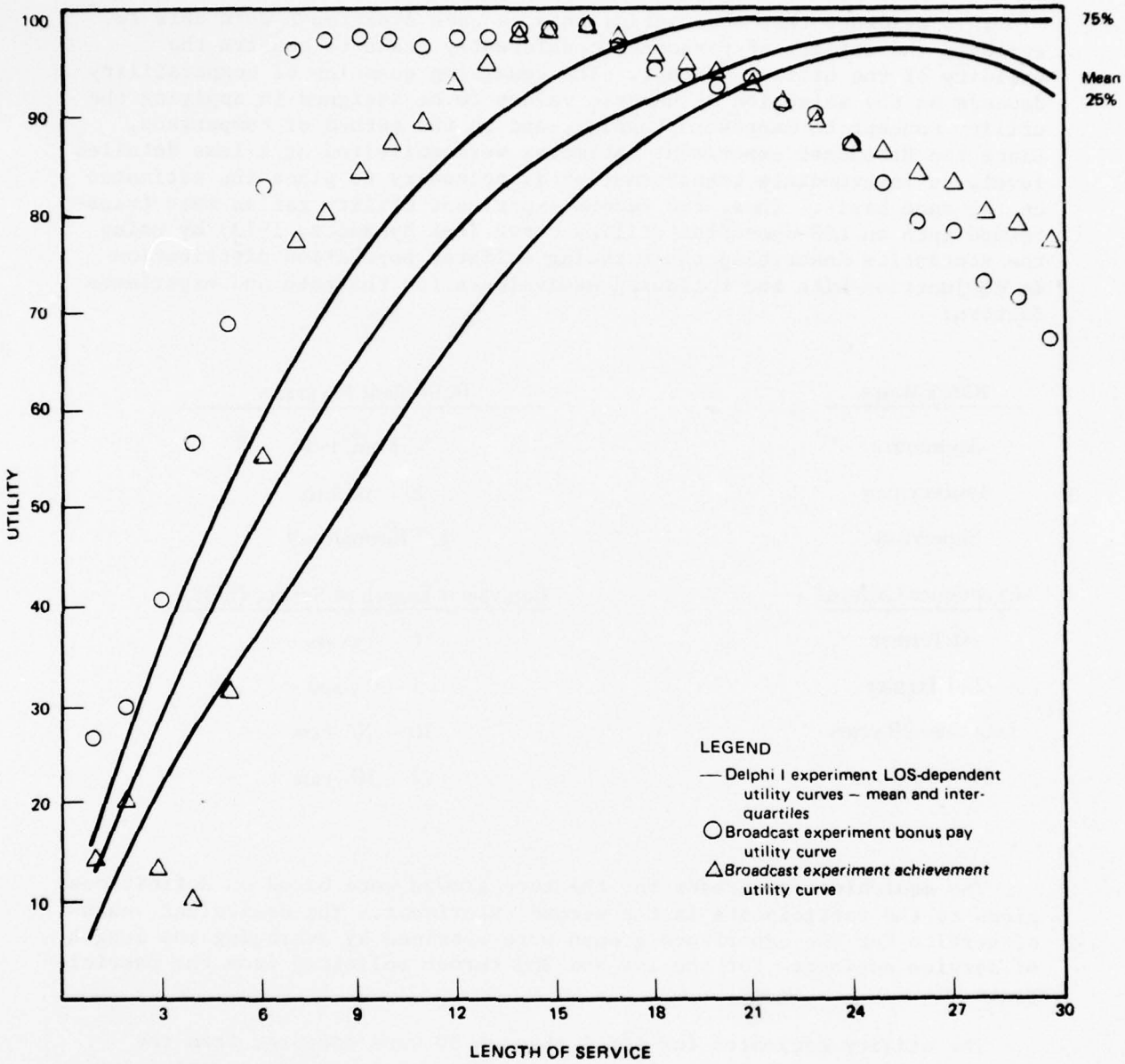

Figure 10. Comparison of results of Delphi I and Broadcast experiments.

This evidence that the participants in each experiment were able to evaluate the utility of personnel consistently tends to confirm the validity of the utility concept. The remaining question of comparability depends on the selection of numeric values to be assigned in applying the utility concept to manpower planning, and on the method of comparison. Since the Broadcast experiment estimates were solicited at a less detailed level, an intermediate transformation is necessary to place the estimates on the same basis. Thus, the second experiment utility tables were transformed into an LOS-dependent utility curve (B-K Dynamics, 1973) by using the statistics describing the existing enlisted population distribution in conjunction with the following equivalents for the rate and experience factors:

Rate Groups	Equivalent Paygrade
Apprentice	E-3 and E-4
Journeyman	E-5 and E-6
Supervisor	E-7 through E-9
Experience Groups	**Equivalent Length of Service (LOS)**
1st Termer	1 – 4 years
2nd Termer	5 – 9 years
Less than 20 years	10 – 20 years
20 – 30 years	21 – 30 years

The equivalent paygrades for the rate groups were based on definitions given to the participants in the second experiment. The equivalent years of service for the experience groups were obtained by averaging the length of service estimates for the 1st and 2nd termer solicited from the participants.

The utility estimates for LOS 1 through 30 were computed from the tabular estimates for each rate group in the experience group containing the LOS. The computation used the actual population proportions of apprentices, journeymen, and supervisors (as defined by their equivalents) to develop a weighted average utility estimate at each LOS.

The essential point to be realized from this brief description is that the shape of the constructed utility curves depends not only on the participant's estimates, but also on the population statistics. At the extreme,

one could assert that the transformation of a participant's tabular estimates into LOS-dependent estimates can be valid only if the participant's own estimate of the population mix is used. At the other extreme, the curves could, of course, be made more nearly the same by using a carefully selected or constructed population mix. As a practical matter, it appears reasonable to use the existing population mix.

In examining the LOS-dependent utility estimates, it is seen that, for the first 5 or so years of the career, the mean utility curve from the first experiment is approximately midway between the bonus pay and achievement utility estimates. Over the 5 to 20 year span, however, both utility estimates from the Broadcast experiment are consistently higher than the mean utility curve. Some of this disparity could be due to bias introduced by the transformation technique which produced estimates that were also consistently higher than the LOS-dependent utility curves in the mid-career years. Some of this effect was attributed to the participants' misconception of the true population mix. The remaining disparity could be due to bias introduced by the transformation technique or by the population statistics. This bias could be operative in the transformation of the second experiment utility estimates.

Over the 20 to 30 year span, the differences are quite distinct and irreconcilable. The participants in the second experiment, within the framework of the proxies used for utility, see a much more pronounced decline in the usefulness of the average Navy enlisted man. The decline in utility in the fourth experience group is also quite evident in the tabular presentation. Whether this drop in utility as seen by the participants in the second experiment is true or not is an important issue for the Navy. However, for our purposes, these distinct differences may not be of overall significance in their intended application in the utility model due to the relatively smaller numbers of enlisted men with more than 20 years of service.

It is believed that the limitations to generating comparable numeric estimates, as discussed above, are inherent with any transformation technique. For this reason, the apparent differences between experimental results should be given less weight than the apparent consistency of results within the experiments. This factor, together with the intended application of the data, argues against rejection of the utility concept.

The cost and personnel inventory strength data with which the utility estimates are to be compatible are in a 9-grade by 31-year format. Since the utility curves describe the change in usefulness of the average enlisted man progressing through the system, the utility curves supply only certain elements of the 9 x 31 matrix (Figure 11). Completion of the matrix for LOS-paygrade cells, other than those of the average enlisted man, requires estimates of the utility of the enlisted man whose pattern of advancement is different from the average. One way of posing the problem is to examine

the change in utility of a man at a given grade who remains at that grade throughout his career. The solution to this problem for each of the paygrades could then be employed with the present utility curves to complete the matrix. The pattern of change could be approximated by using a log-learning curve, or by employing the tabular estimates in the second experiment which show the relative change in utility of each given rate group with increasing experience. To respond to this problem and to further explore the personnel utility concept, a third experiment was conducted.

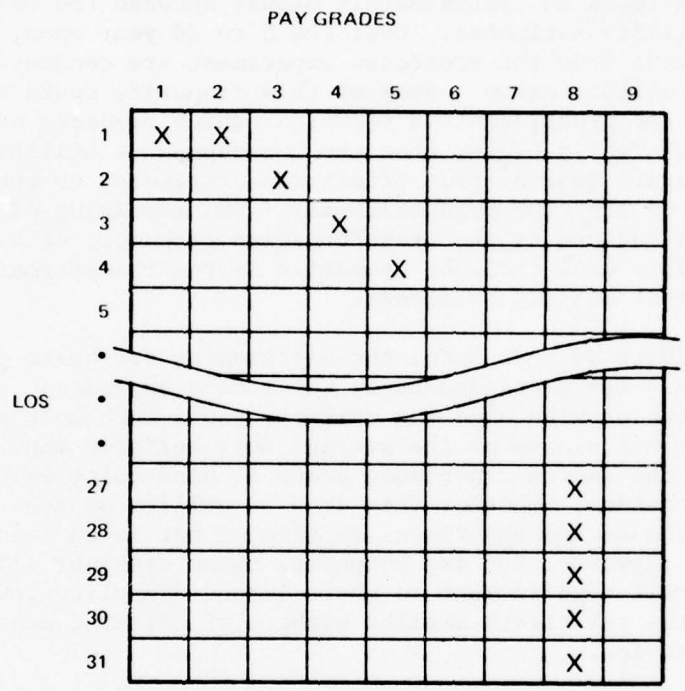

Figure 11. Career path of the average progressor.

Delphi II Experiment

After completion of the Broadcast experiment, a prototype utility model was implemented as part of the ADSTAP personnel policy planning and evaluation system. This utility model translated the Delphi I average progressor utility curve into paygrade utility curves. This particular method was chosen from a number of alternatives, the choice turning on the definitions of the average progressor and the average man serving, and certain assumptions about the paygrade utility curves (e.g., no overlap between grades; no E-5 can be worth more than an E-6).

While the prototype utility model was deemed sufficient to support development and testing of an optimization methodology and to provide another factor in evaluation of personnel policies, there was still considerable uncertainty with regard to the paygrade utility estimates. In addition, the disparities between the utility estimates from each experiment, particularly in characterizing the drop in utility of enlisted men near the end of their career, prompted further research into this assessment.

To resolve these questions, a third experiment, Delphi II, was initiated. Since the previous two experiments had involved officers and senior enlisted men serving in a shore tour, this experiment was addressed only to personnel serving on operational billets in the Fleet. In all, some 75 officers and enlisted men (making up three panels) serving in the 2nd Fleet participated in the third experiment.

The questionnaire for Delphi II (Appendix A) was designed to address the particular questions raised as a result of the first two experiments. Because of the clear advantage of the Delphi procedures over broadcast one-shot questionnaires, a Delphi exercise was chosen as the vehicle for the third experiment.

In the previous experiments, both graphic and tabular estimates of personnel utility had been solicited. Since results of the first experiment showed that estimates obtained from the two methods were comparable, there was no need to choose between methods. There was, however, a need in the second experiment to isolate certain questions about the utility of an enlisted man that suggested that the following characteristics of the utility curve should be addressed separately:

1. The slope--the rate (growth) at which the average enlisted man attains usefulness to the Navy.

2. The peak--the year of service at which the average enlisted man reaches his peak usefulness.

3. The late years--the change, if any, in usefulness of the average enlisted man beyond the years after he reaches his peak.

The questionnaire developed for the first round of the Delphi II experiment was organized into four parts. Part 1 was designed to solicit estimates which could be compared to the results of the two previous experiments. The following five questions were posed regarding the utility of the average enlisted man progressing in paygrade and length of service:

1. At what year of service does the average progressor reach his maximum value to the Navy?

2. Until what year of service does he maintain his maximum value?

3. If the answer to question 2 is less than 30, what is his value to the Navy in the 30th year (as a % of his maximum value)?

4. How much of his maximum value has he obtained by the time he reaches the end of his first enlistment (as a % of his maximum value)?

5. In what year of service does he reach 50% of his maximum value?

Part 2 solicited estimates regarding the utility of an average enlisted man as he progresses in years of service while remaining at a specific paygrade. For each paygrade, E-3 through E-9, the participants were asked to supply the following three estimates:

1. At what year of service does a man reach his maximum value in this paygrade (year from 1 to 30)?

2. Assume the man remains in the paygrade throughout the remainder of his 30-year career. Until what year of service does a man in this paygrade maintain his maximum value (year from 1 to 30)?

3. If the answer to question 2 is less than 30, what is his value to the Navy at 30 years (as a percentage of his maximum value at this paygrade)?

Part 3 solicited estimates of the maximum value attained by the average enlisted man at a paygrade in relation to all others paygrades. To set the scale, the assumption was made that the maximum value attained by the E-9 is 100.

Part 4 solicited estimates of the value of the average enlisted man upon entrance to the Navy. As a proxy, the participants were asked to estimate on a scale ranging from 0 to 100 the value of Direct Procurement Petty Officers (DPPOs) at advanced paygrades E-2 through E-9.

Analyses of the results and rounds 2, 3, and 4 of the experiment proceeded in accordance with conventional Delphi procedures. Means and interquartiles were computed and recycled back to the participants for reevaluation. Requests for additional information were honored and rationale statements and defenses were abstracted and circulated.

Summary results from the first round of Delphi II are illustrated in Figure 12, Table 1, and Figure 13. For Figure 12, the responses of all the participants to Part 1 of the questionnaire were averaged, and the resultant average progressor curve (tent) was plotted against Delphi I and Broadcast questionnaire results. The maximum value of the average progressor curve falls within the interquartiles of the Delphi I curves, while the career-end portion corresponds more closely with the broadcast experiment estimates. (See Appendix B for Summary Statistics, Delphi II Rounds 1, 2, and 3).

TABLE 1.
Comparison of Paygrade Utility Estimates from Delphi I and II Experiments

Paygrade	Delphi I	Delphi II, Round 1
E-1	8	15
E-2	17	22
E-3	29	32
E-4	49	48
E-5	67	64
E-6	83	77
E-7	94	89
E-8	98	94
E-9	96	99

In Table 1, the paygrade utility estimates from Part 3 of Delphi II Round 1 are compared with the corresponding estimates from Delphi I. At paygrade E-4 and above, the estimates are, at most, six percentage points different.

In Figure 13, the paygrade utility curves (tents) derived from Parts 2, 3, and 4 of the Delphi II questionnaire are plotted against the results of the previous experiments. At LOS = 0, the average utility estimates characterizing the Direct Procurement Petty Officers are plotted for each paygrade. The maximum values were obtained from the averages of Part 3; these maximum values were combined with the last question of Part 2 to compute the values plotted at LOS = 30.

As may be seen in results of both Delphi experiments, the average enlisted progressor reaches a point of maximum utility at approximately 24-27 years of service and thereafter declines in utility. This general pattern also applies to the average enlisted man at each paygrade. Those who do not get promoted (i.e., those who remain in grade) decline in value to the Navy at advanced years of service.

Even at paygrades E-8 and E-9, this decline at advanced LOS was observed by the participants in the Delphi experiment. Interpretation of these results raises several questions, such as:

1. Does this simply describe "short-timer" behavior, which is not a function of LOS, but, rather, is related to the approaching end of career?

2. Is this evidence that E-8's and E-9's are improperly and ineffectively used by the Navy?

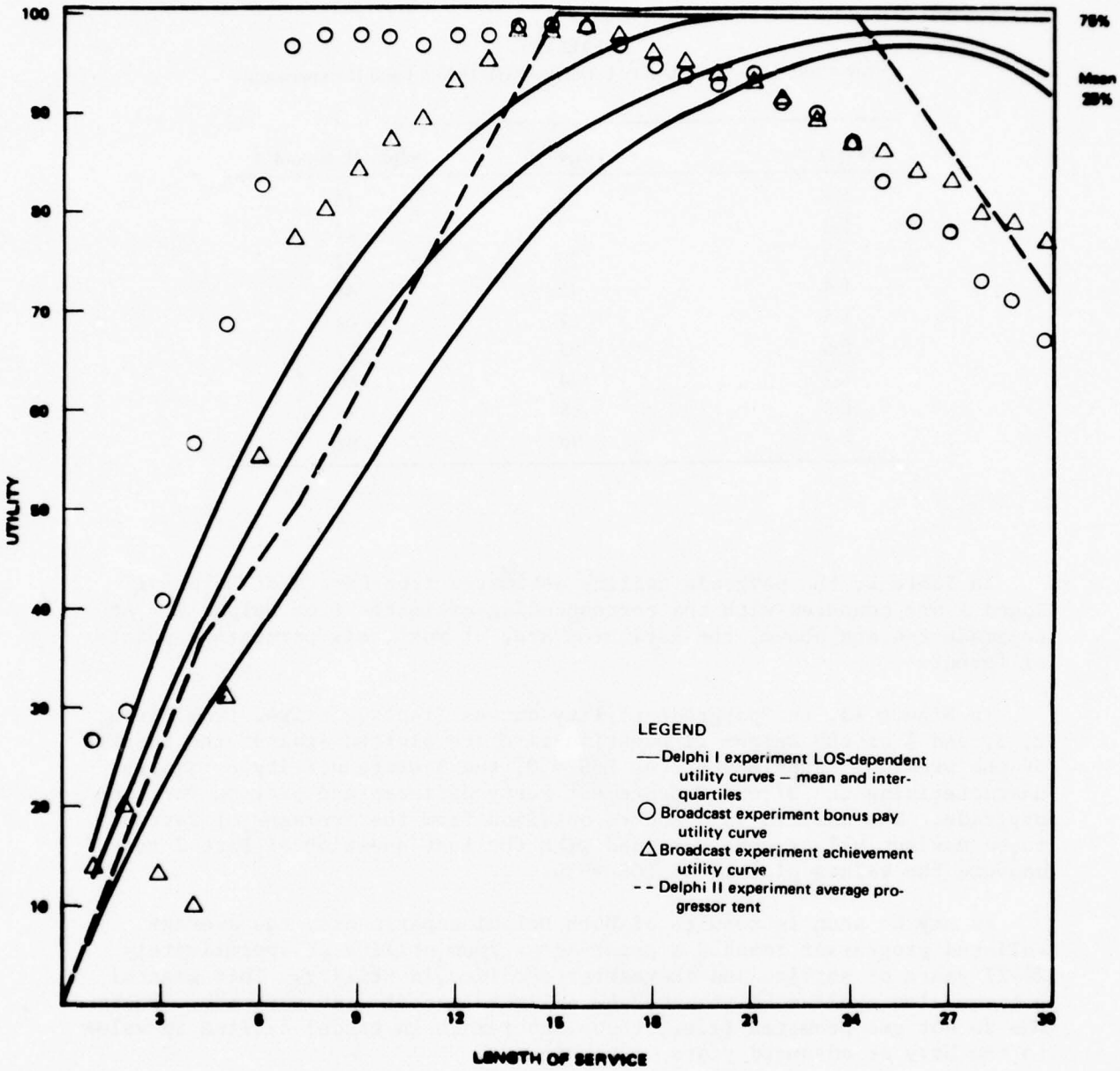

Figure 12. Comparison of Delphi II Round 1 average progressor tent and results of Delphi I and Broadcast experiments.

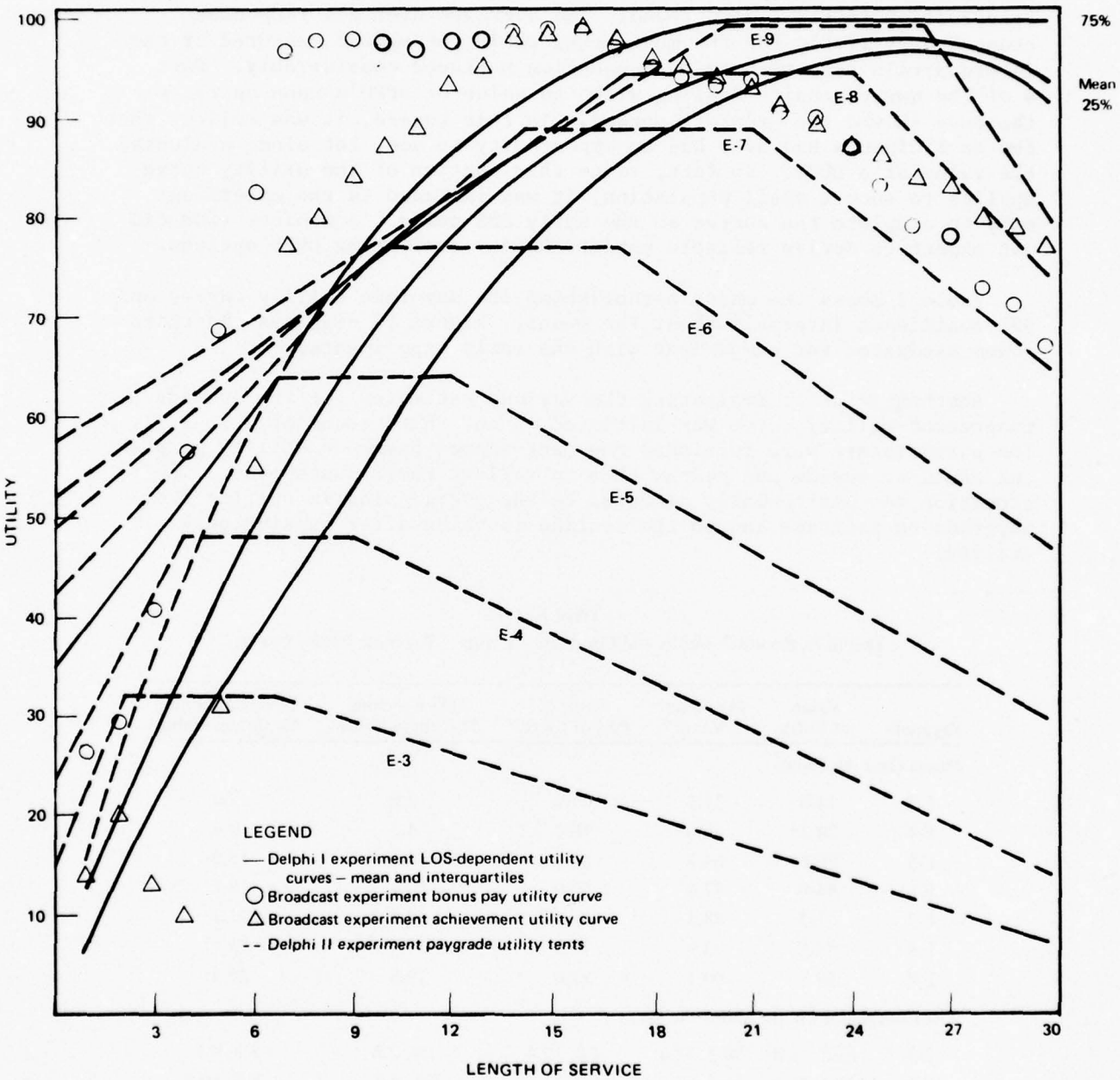

Figure 13. Comparison of Delphi II Round 1 paygrade utility tents and results of previous experiments.

Tabulations of these results were returned to the participants for reevaluation in the second round. The averages over all responses changed very little for the most part, while the spread measured by the interquartile responses to each question narrowed considerably. Part 4 of the questionnaire dealing with the value of DPPO's upon entry to the Navy showed the greatest spread. In this regard, it was evident that few participants had ever had an opportunity to see, let alone evaluate, the value of a DPPO. In fact, since this section of the utility curve applies to such a small population, it was included in the experiment only to complete the curves in the early LOS cells. Administration did not expect to derive reliable yardsticks for evaluating DPPO options.

Table 2 shows the means establishing the paygrade utility curves and 95% confidence intervals about the means. Figure 14 displays the third round estimates for comparison with the early experiments.

Another means of evaluating the various estimates for the average progressor utility curve was initiated on the third round of Delphi II. The participants were furnished the tent-shaped paygrade utility graphs and asked to review and redraw them to reflect their assessment. Their attention was particularly directed to the overlapping in utility from paygrade to paygrade and to the decline in value after passing peak utility.

TABLE 2.

Delphi II, Round 3, Means and Confidence Limits — Paygrade Utility Curves

Paygrade	Value at Entry	Maximum Value	Value at End of Career	LOS Reaching Maximum Value	LOS Maintaining Maximum Value
Means Over All Panels					
E-3	14.8	31.3	9.9	2.6	7.3
E-4	24.7	46.6	18.7	4.3	9.6
E-5	36.6	64.7	34.7	7.1	13.3
E-6	45.0	77.4	50.0	10.4	18.1
E-7	51.2	88.5	66.4	14.4	21.7
E-8	55.5	93.9	77.5	17.4	25.1
E-9	59.5	99.1	85.6	19.8	27.3
95% Confidence Limits About the Mean					
E-3	13.2, 16.4	30.2, 32.4	7.4, 12.4	2.4, 2.8	5.5, 9.1
E-4	23.0, 26.4	45.7, 47.5	15.8, 21.6	4.1, 4.5	8.3, 10.9
E-5	34.3, 38.9	62.9, 66.5	30.4, 39.0	6.8, 7.4	12.4, 14.2
E-6	42.8, 47.2	76.2, 78.6	45.3, 54.7	10.2, 10.6	17.5, 18.7
E-7	48.4, 53.9	87.8, 89.2	61.7, 71.1	14.0, 14.8	21.1, 22.3
E-8	52.8, 58.2	93.3, 94.5	73.7, 81.3	16.9, 17.9	24.5, 25.7
E-9	56.6, 62.4	98.7, 99.5	81.7, 89.5	19.1, 20.5	26.9, 27.7

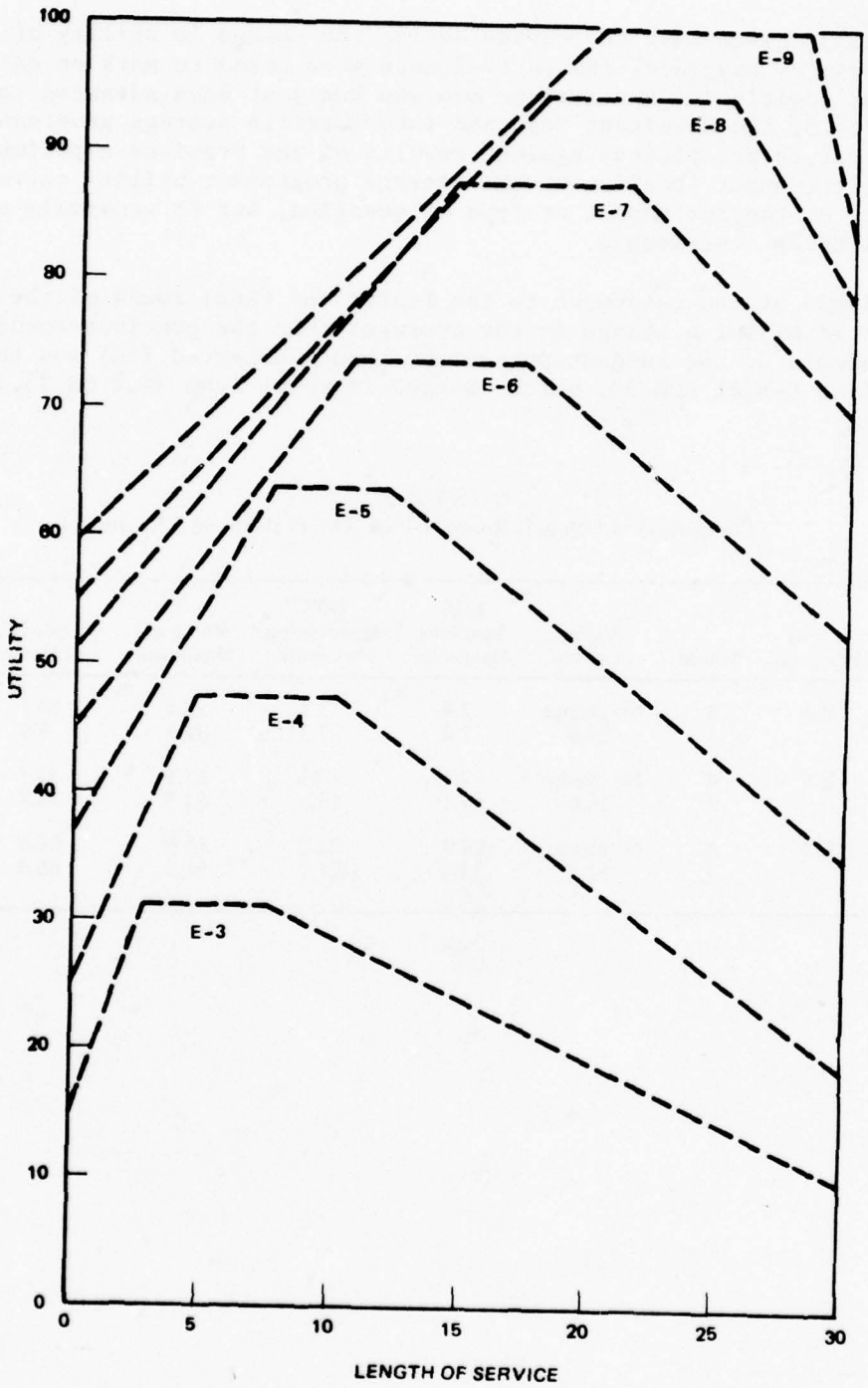

Figure 14. Delphi II Round 3 paygrade utility tents.

Finally, given that the curves define the change in utility of the average man by paygrade, the participants were asked to mark on each curve the position of the average man who has just been advanced to grade. In Figure 15, the resultant mean and interquartile average progressor utility curves are plotted against results of the previous experiments. As seen, the exact location of the average progressor utility curve varies depending on the instrument or type of question, but is generally similar over all three experiments.

Analysis of the responses to the fourth and final round of the experiment should minimize change in the averages from the previous round. As seen in Table 3, the largest percentage change observed (4%) was the utility value of an E-5 at LOS 30, which changed in value from 34.7 to 33.3.

TABLE 3.
Comparison of Delphi II Round 4 – and Delphi II Round 3 Results

Paygrade	Round	Value at entry	LOS Reaching Maximum	LOS Maintaining Maximum	Value at Maximum	Value at End of Career
E-3	4	No change	2.8	7.1	32.7	10.1
	3	14.8	2.6	7.3	31.3	9.9
E-5	4	No change	7.1	13.5	65.1	33.3
	3	36.6	7.1	13.3	64.7	34.7
E-7	4	No change	14.0	22.2	89.0	68.6
	3	51.2	14.4	21.7	88.5	66.4

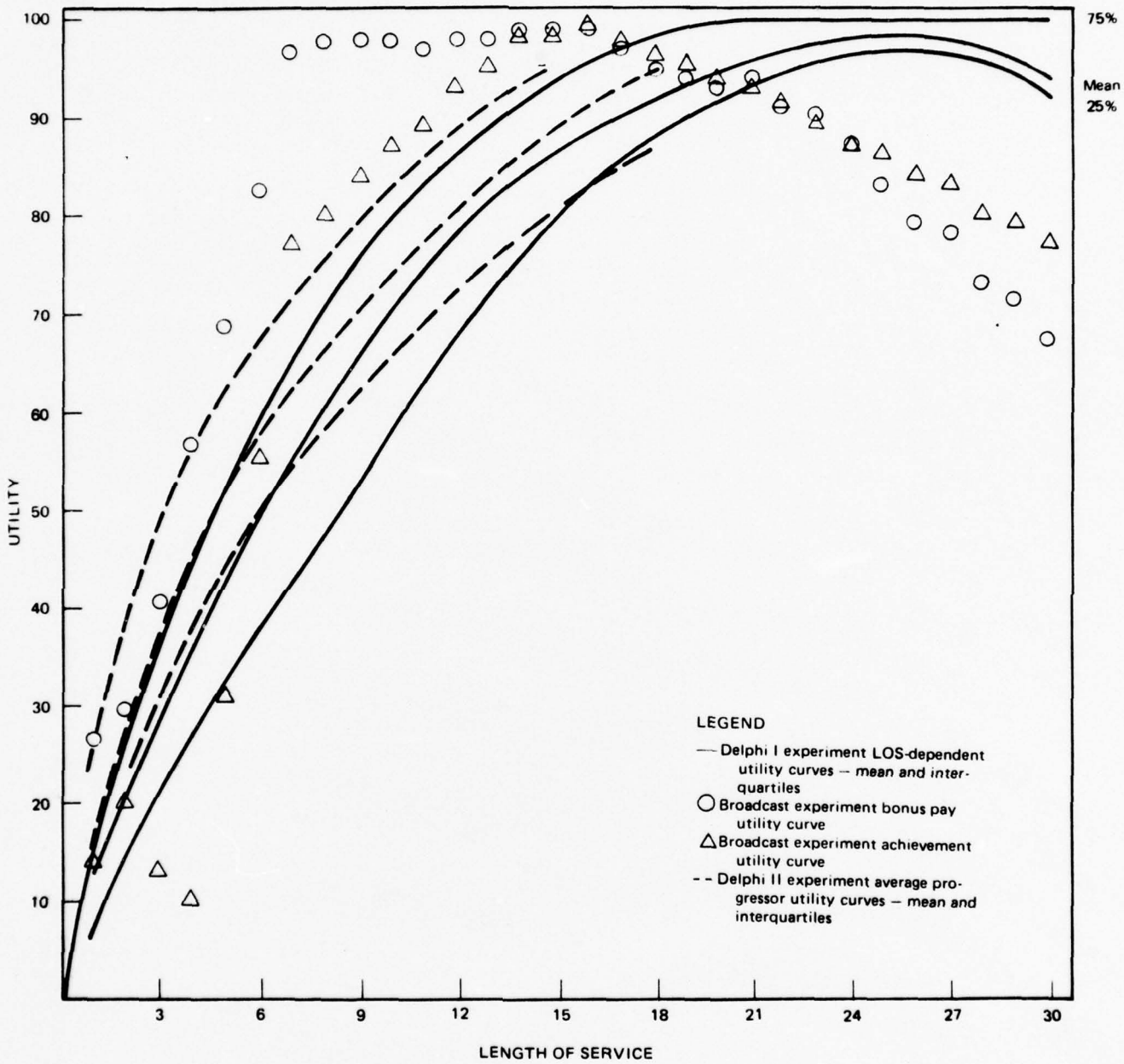

Figure 15. Comparison of Delphi II Average progressor utility curves and results of previous experiments.

CONCLUSIONS

From the consistency of the results in both Delphi experiments, it can be concluded that the Delphi technique seems to be a valid technique to measure the utility of the enlisted man by paygrade and LOS.

Since an enlisted man's usefulness decreases if he remains in the same paygrade (i.e., does not get promoted) after a period of time, the Navy could possibly benefit by employing "early out" policies for enlisted men with no chance of promotion.

RECOMMENDATIONS

The results of this study should be used to develop a utility model to help the Bureau of Naval Personnel define long-range management goals for the Navy Personnel enlisted force. The utility model could be used along with other models such as cost, inventory, and reenlistment elasticity models to optimize personnel force distributions by skill grouping, length of service, and paygrade.

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APPENDIX A

DELPHI II QUESTIONNAIRES

Contents

1.	Delphi II, Round 1, Questionnaire	A-1 to A-7
2.	Delphi II, Round 2, Questionnaire	A-8 to A-18
3.	Delphi II, Round 3, Questionnaire	A-19 to A-32
4.	Delphi II, Round 4, Questionnaire	A-33 to A-41

Delphi II, Round 1, Questionnaire

DEPARTMENT OF THE NAVY
BUREAU OF NAVAL PERSONNEL
WASHINGTON, D.C. 20370

IN REPLY REFER TO
Pers-Ax/clw
Ser 398/73

MEMORANDUM FOR PARTICIPANTS IN DELPHI EXPERIMENT

Subj: DELPHI Determination of Utility

Encl: (1) Test Questionnaire

1. In recent months a considerable amount of research has been done in general utility theory as applied to military manpower. One of the outgrowths of this research is an attempt to use the DELPHI survey method to determine the utility to the Navy of enlisted men as they progress in both length of service and paygrade. The attached questionnaire is one test vehicle designed to get at this very difficult concept.

2. You have been selected as one member of a panel to evaluate this concept. In the DELPHI methodology, two points are paramount: first, iteration of results and second, anonymity. You will receive a second questionnaire, and perhaps a third and fourth later, in which the results of previous questionnaires are fed back to you with requested additional information and a review of comments made by others. None of the panel members will be cited by name, so you will be required to review the results based on the overall group view, not the relative ranks or authority of individual respondents. You may know some or most of the other respondents in this experiment. Some of you may even be in the same unit. Therefore, please preserve the necessary anonymity by not discussing this experiment with others until the experiment is completed.

3. On the blank sheet attached to the questionnaire, please indicate to the extent you can (1) any general assumptions or rationale behind your answers, and (2) any request for additional information which, if available, you think would help you make more valid judgments about these questions.

4. The concept of the utility to the Navy of the average man, during a thirty year career, is one which requires some new thinking about enlisted men which has not been required in your previous tours. On the other hand, there is no way this question can be answered without drawing on the actual experience you have had in leading enlisted men in the Navy environment. The following points cannot define in detail the concept in which we are interested; to do so might drive the answers, which we don't want to do. These points may, however, help you to clarify the concept in your own mind. Most of the questions refer to the average sailor as he progresses from E1 to E9 in a thirty year career. Everyone has two

"average sailors" in mind; one, the average of the people who have worked for him and two, his own idea of what an average sailor, Navy-wide, is. These are usually not the same. In this questionnaire, we want you to respond based on the people you have known and with whom you have worked. The Navy-wide average man should then develop later as a result of the integration of all the questionnaires. It is very difficult to separate the ideas of utility to the Navy, in general, and utility in a specific job. The Navy pays an E-7 a great deal more than it pays to an E2. Intuitively, the Navy must believe that the E7 is worth more. If, however, you try to tie the concept to a specific billet, the concept becomes very troublesome. Obviously, it is very hard to decide who would be most useful for chipping paint, an E2 or an E7. If possible, try to take the broader view of the "general good". One way to look at it, which may be helpful to you, is to try to answer this question: "Paygrade not withstanding, in an emergency situation, how much of the total rating work would I trust a man of a specific paygrade and experience level (length of service) to do for me?" For most naval officers, this would result in ascribing a higher value to a chief than to a striker.

5. If you would like to discuss the concept personally before we are through, please call Bob Lehto, Pers-Ax (Autovon) 224-4491. When you have completed this questionnaire, please mail in enclosed envelope. If possible, attempt to complete the questionnaire and return it in a week to ten days.

R.K. LEHTO
Special Assistant for
Enlisted Force Analysis

QUESTIONNAIRE

A. Consider first the average Navyman; the man who completes a thirty year career and progresses normally through all the paygrades from E1 to E9. We make the following general assumptions about this man's value or usefulness to the Navy. The average recruit is assumed to enter the Navy with zero value. This doesn't mean we think recruits are worth nothing, but rather that we are trying to measure the added (or accrual) usefulness that a man gains while he is in the Navy. We further assume that as a man is trained and gains experience, his usefulness to the Navy increases. At some point in his thirty year career, the average progressor will reach a point of maximum value to the Navy which we will define here as 100 or 100%, whichever nomenclature you prefer. The following questions solicit your views as to how this man's value or usefulness to the Navy changes as he progresses. In general, the questions ask that you make judgments in relation to the maximum value of 100 defined above.

1. At what year of service does the average progressor reach his maximum value to the Navy?

_____th year of service

2. Until what year of service does he maintain this maximum value?

_____th year of service

3. If your answer to question 2 was less than 30, what is his value to the Navy in the 30th year?

_____% of his maximum value

4. How much of his maximum value has he obtained by the time he reaches the end of his first enlistment? (Assume a first enlistment length of four years.)

_____% of his maximum value

5. In what year of service does he reach 50% of his maximum value?

_____th year of service

B. The questions in A above dealt with the value of the average Navyman who progresses in paygrade through his thirty year career. This next question requires information about an average man as he progresses through a specific paygrade. A table is provided below for your answers. The three questions are repeated here with the keys to the table. The years should be specified on a basis of total career length of service (1-30).

"MAXIMUM YEAR"--At what year of service does a man reach his maximum value in this paygrade? (Year from 1-30)

"MAINTAIN YEAR"--Assume the man remains in the paygrade throughout the remainder of his 30 year career. Until what year of service does a man in this paygrade maintain his maximum value? (Year from 1-30)

"VALUE AT 30TH YEAR"--If your answer in the MAINTAIN year column was less than 30, what is his value to the Navy at 30 years (<u>as a percentage of his maximum value at this paygrade</u>)?

PAYGRADE	MAXIMUM YEAR	MAINTAIN YEAR	VALUE AT 30TH YEAR
E-3	_____th	_____th	_____%
E-4	_____th	_____th	_____%
E-5	_____th	_____th	_____%
E-6	_____th	_____th	_____%
E-7	_____th	_____th	_____%
E-8	_____th	_____th	_____%
E-9	_____th	_____th	_____%

C. The previous questions have concerned themselves with the change over time of value of the average enlisted man. This next question deals with his value at a paygrade in relation to all other paygrades. Indicate in the table below on a scale of 0-100 the average value of the average progressor at each paygrade.

VALUE OF AVERAGE PROGRESSOR	
E-1	_____
E-2	_____
E-3	_____
E-4	_____
E-5	_____
E-6	_____
E-7	_____
E-8	_____
E-9	_____

D. In the past the Navy has, at one time or another, recruited men at advanced paygrades based on their civilian experience. Some of these programs have been called Direct Procurement Petty Officer (DPPO) programs. In general, these programs have assumed that the man had the technical qualifications for the paygrade and could learn the "Navy way" on the job. Please indicate below your judgments as to the value (on a scale of 0-100) of such men at the time of recruitment. In other words, we are asking for judgments about the value of a man at a specific paygrade but with zero years of service.

	VALUE
E-1	_____
E-2	_____
E-3	_____
E-4	_____
E-5	_____
E-6	_____
E-7	_____
E-8	_____
E-9	_____

Delphi II, Round 2, Questionnaire

DEPARTMENT OF THE NAVY

BUREAU OF NAVAL PERSONNEL

WASHINGTON, D.C. 20370

IN REPLY REFER TO
Pers-2X/mmo
Ser 717/73
AUG 1 0 1973

MEMORANDUM FOR PARTICIPANTS IN DELPHI EXPERIMENT

Subj: DELPHI Determination of Utility; second questionnaire

Encl: (1) Additional Discussion of Experiment
(2) Your First Questionnaire (not included)
(3) Averages of Response to First Questionnaire (not included)
(4) Second Questionnaire (not included)
(5) Additional Information Requested on Pass #1

1. The responses to the first questionnaire have been analyzed and the results are returned herewith. In general, the data received was about what we expected. That does not mean that the answers are the same as we received on previous experiments. We cannot, as yet, tell how similar or dissimilar your responses are to the previous ones. We can, however, detect the internal consistency we have come to expect between each individuals answers, question to question, and between separate individuals and the rest of the panel.

2. The enclosures provide the material necessary to complete your second questionnaire. A few of the concepts introduced in the first questionnaire proved to be particularly difficult. As a result these concepts are discussed further in enclosure (1). Most of the panelist's rationale statements centered around a few points and these have also been summarized in enclosure (1) together with some particularly thorough rationale statements from some of the participants. The rationale has been summarized across all panels so you are seeing comments from all three panels. Enclosure (2) is your own first questionnaire returned as you filled it out. Where your answers to a specific question were statistically different from the rest of your panel, those answers have been circled in red. Pay particular attention to these questions. If you feel that your answer is more valid than that of the rest of the panel, we will need a statement of why you believe so. Don't back down; if you think you are right, say so!

3. Enclosure (3) shows the average answer given to each question by your panel members. Remember these are the averages of <u>your panel only.</u> Enclosure (4) is a blank questionnaire to be filled out on this second pass. Enclosure (5) is the additional information that was requested by individuals regardless of panel membership. It may or may not be of use to you in continuing the experiment.

4. There is no particular way to go about completing this second step. Let me suggest one way that may be useful. After reading through the

Subj: DELPHI Determination of Utility; second questionnaire

whole package thoroughly, take it apart and lay enclosure (2), (3), and (4) side by side. Evaluate your first answer in light of the panel averages and the additional information you now have and then record your new response on the blank questionnaire. Remember to pay particular attention to those questions we have marked in red on your original questionnaire.

5. You need return only your answers to questions 1 and 2 on the last page of enclosure (1) and your completed enclosure (4) in the self addressed envelope. Save the remainder of this package for use in the next pass.

R. K. LEHTO
SPECIAL ASSISTANT FOR
ENLISTED FORCE ANALYSIS
BUREAU OF NAVAL PERSONNEL

ADDITIONAL DISCUSSION OF EXPERIMENT

General Comment:

Despite a good bit of griping about the problems of dealing with the average man, surprisingly high percentage of you (higher than usual) were able to discuss the problem and provide internally consistent answers to the questions. The average man concept is troublesome, but perhaps if viewed in a different way it may be a little easier to deal with. The average progressor is not any one single man who progresses from 0 to 30 years LOS. Rather he is a fictional central figure representing all the people in his grade and LOS at any particular time. In the period from zero to about 4 to 7 years, depending on the skill, the average man is the average of both those who stay and those who will go home. In the years from 4 to 20 the average progressor represents those who "go the distance" as well as those who drop along the way. He also represents the mix of the fast, medium and slow advancers. Beyond 20 years, the average progressor is the average of those who stayed past twenty. You must evaluate these kind of people to get an average, not only among themselves, but also as compared to those who left at 20.

Please examine closely your answers to Question C. Remember, if you say that a man reaches 50% of his maximum value by the time he is an E4 you are saying that half of all this guy can contribute is under his belt in the first 2 or 3 years. It will take him 17 to 28 years to get the other half of his value. The answers to Question C. are the most important part of this first phase of the questionnaire. Consider them carefully.

Panels Rationale Statements:

Most of the rationale statements dealt with the concept of utility, the average man (discussed above), or the reasons for the answers given about the average progressor. All have been noted, but have only been quickly summarized here, because, in general, they are the same as were discussed in the original briefing. There were, however, two particular points in most of the rationale statements, which merit special attention.

(1) Most people discussed their rationale for the decline in value at a pay grade after a certain period of time. In general, they cited disillusionment, lack of motivation, lack of challenge, or just "in a rut." We accept this decline in value at each pay grade, but the important question is how much does it decline. Pay particular attention to the form of the question. Where we ask for % of maximum value in Question B., we don't mean in comparison to an E9 necessarily but in comparison to the maximum attained at that pay grade. For example, if you said that an E5 was at his peak from 7 to 12 years, we want to know in percentage terms, how much of that peak value does he have left if he goes for 30 and stays at E5? A similar approach should be taken to each other pay grade.

(2) The question of the value of DPPO's was especially difficult as many of you pointed out during the briefings. We must, however, determine a value for people at early years in pay grade regardless of how they got there. Perhaps one way to look at it is to say: A man who has only one year of service at a paygrade (for example E5) got there because of tech-

nical ability but, as many people pointed out, he lacks military leadership skills and therefore does not have the full value of a man who grew up in the system. Therefore, one measure of a man's value at any pay grade in the first year of service is the percentage of that pay grade's value which can be attributed as technical as opposed to military skills. I realize this won't help much at E8 and E9, but it may help in answering Question D for pay grades E7 and below.

Selected Rationale Statements:

Three rationale statements are attached here verbatim as Tabs A, B, and C. They were chosen as representative; there were many others as good. Some people worked out curves and even completed tables for us. We did not include these rationale statements, but will deal with them on pass three. For those of you who did draw curves or filled out tables, you would be surprised at how close your answers look to the averages of the panels and to the results of the previous experiments.

Additional Questions to be Answered:

Only one additional piece of information will be addressed in this second round. In future rounds, we will be addressing the question of pay grade overlap, that is the extent to which the value curves overlap from pay grade to pay grade. In order to help us write the appropriate questions, we would like your views. On the bottom or back of this sheet please answer the following questions. Remember, we are primarily interested in the LOS dimension.

1. Under what circumstances do you believe that the average E5 is worth more than the average E6?

2. Under what circumstances is the average E5 worth less than the average E4?

Enclosure (1)

PANELIST'S RESPONSE I

ASSUMPTIONS/RATIONALE

A. I have had little direct experience with petty officers with more than 20 years service; my answers are based on this limited experience and, I feel, are stretched towards the 30 mark as a result of the format of the questionnaire.

B. The answers to questions A1 and A2 depend on a large degree to the billet assignment and the demands and challenges placed on that billet. In many billets there is a level of proficiency required where more experienced and more highly trained personnel do not necessarily produce improved performance. I feel that there is a burn out effect whereby a top young performer can have his performance decline when exposed to long term rigors of a demanding position. When removed from this position (perhaps one where he has served before; e.g. SSN Sonarmen, MTs and FTs, and some nuclear billets), he can reach new performance levels through the challenge of a different assignment.

C. Question A4 is rating dependent. This percentage is achieved earlier in less skilled ratings.

D. Question D was answered on judgment; I have no experience in this matter. This "value" would be largely dependent on the person recruited and the recruiter's adherence to well-defined standards which have been previously established.

PANELIST'S RESPONSE II

Basic rationale for my answers is contained in the chart below:

	A Minimum Time In Previous Grade For Eligibility	B Minimum Longevity To Advance To Grade	C My Guess Average Longevity To Advance To Grade	D My Guess Average Eligibility To Advance To Next Grade	E Arbitrary Decline Point Column D+2 Yrs.
E9	2 years	12.5 years	18 years	———	24
E8	3 years	10.5 years	16 years	18 years	20
E7	3 years	7.5 years	10 years	16 years	18
E6	2 years	4.5 years	6 years	10 years	12
E5	1 years	2.5 years	3.5 years	6 years	8
E4	6 months	1.5 years	2.0 years	3.5 years	5.5
E3	8 months	1.0 years	1.2 years	2.0 years	3.0*
E2	4 months	4 months	4 months	1.2 years	2.0*
E1	———	———	———	———	———

* Exceptions to D+2 years if no advancement by years shown, demotivation, "short" attitude and poor performance follows.

Rationale by Questions:

A.1. Maximum value to the service comes at (E-9/C)
2. Arbitrary decline point is (E-9/E)
3. Pure guess
4. By the end of 4 years average progressor should be an E-5, where I value at 60%.
5. 50% value should come just before E-5, i.e. 3.5 years (E-4/D) or E-5/C-something)

B.1. Maximum year equates to column D, when a man should be ready for advancement. If my estimate is wrong, crank in actual figures for column D and that is my answer.

Maintain year equates to column E. After a man goes 2 years past his average eligibility for advancement I believe he cannot maintain maximum utility due to new self image, which has to be adjusted downward to match level attained.

Value at 30th year is a pure guess. I don't think those figures are

worth looking at. We can expect decline. We are already guessing where it takes place. To superimpose a guess on a guess is a wasted effort.

C. Jump at E-4 and E-5 is due to experience as a worker. E-6 added value is in the supervisory skills primarily. Additional value of E-7 is due to leadership development and his acceptance as "The Boss" in a shop. E-8 and E-9 gains are small in this area. I still think this a helluva a way to try to rationalize our manpower structure. There are better ways to come up with these answers than a figure that represents an agreed-upon guess or an unidentifiable quantity: "The worth of an average man".

But I'll play the next round.

PANELIST'S RESPONSE III

Comments and suggestions:

A. The assumption that the average Navyman completes a thirty year career as an E9 is not valid. I feel the average man will progress only to E6 or E7. The average E8 and E9 are or should be exceptional individuals.

1. Maximum value of an E9 does not occur until about 25 years.

2. Maximum value of many individuals continues beyond 30 years.

4. Major training was completed during the first enlistment. Additional training and experience will increase value, but diminishing returns set in beyond this point.

B. Value of an individual as related to cost remains fairly constant, but value as a source of individuals who can progress to higher pay grades decreases linearly.

C. The value of individuals, by pay grade, depends upon many factors: Time required to make a pay grade, capabilities of individuals in a given pay grade, training required, money invested, usefulness, requirements, etc. While individuals in higher pay grades are usually assumed to be capable of performing any task, the fact is that certain tasks require specialists in lower grades. Value based on cost is low for an individual assigned to any job which could be performed by an individual in a lower pay grade. To maximize value, individuals must progress as high as their capabilities permit and they must be utilized to the maximum extent of those capabilities. The most qualified individual in paygrade E9 has no value if he is not utilized.

D. The overall value of these individuals is almost equal to that of their military contemporaries. The major drawback is the time required to gear them to the military environment. Also, much depends on the specific task for which they were recruited; some billets can be filled only by well qualified men with a comprehensive military background while others require almost no military background at all.

Enclosures 2, 3, and 4 to

second Delphi Questionnaire not reproduced

in this appendix.

Additional Information Requested on Pass #1

1. Average time in grade when advanced, based on pay entry base date (PEBD).

E2	E3	E4	E5	E6	E7	E8	E9
.3	.9	1.6	1.7	3.6	5.5	4.5	3.0

2. Average time in the Navy when advanced, based on PEBD.

E2	E3	E4	E5	E6	E7	E8	E9
.4	1.1	2.3	3.7	9.0	14.8	16.9	19.6

3. Paygrade (PG) vs length of service (LOS) of the average enlisted man based on June 1972 inventory.

E1	E2	E3	E4	E5	E6	E7	E8	E9
.6	1.1	2.2	3.4	6.6	13.1	17.4	19.7	22.7

Retirements (Disability not Included)

Length of service (LOS) and paygrade (PG) of retirements from USN during first six months of 1973.

LOS	E9	E8	E7	E6	E5	E4	E3	Total Per LOS	% Per LOS
Undetermined	2	4	24	65	16	1		112	3.17
17	1	3	21	75	8			108	3.05
18	19	43	239	294	27	1		623	17.62
19	48	94	559	495	148	22	3	1369	38.72
20	24	77	288	189	38	8	1	625	17.67
21	32	61	132	62	17			304	8.60
22	22	28	57	14	3			124	3.51
23	6	9	19	7				41	1.16
24	4	13	21	8	2	1		49	1.38
25	9	11	18	7	4			49	1.38
26	7	8	25	2	1			43	1.22
27	8	11	13	10	3	1		46	1.30
28		9	4	1				14	.40
29		2	7	5	2			16	.45
30 or more			3	10				13	.37
Total Per PG	182	373	1430	1244	269	34	4	3536	
% Per PG	5.15	10.55	40.44	35.18	7.61	.96	.11		100.00

Delphi II, Round 3, Questionnaire

DEPARTMENT OF THE NAVY
BUREAU OF NAVAL PERSONNEL
WASHINGTON, D.C. 20370

IN REPLY REFER TO
Pers-2x/mmo
Ser 1010/73
Nov 12 1973

MEMORANDUM FOR PARTICIPANTS IN DELPHI EXPERIMENT

Subj: DELPHI Determination of Utility; third questionnaire

Encl: (1) Additional Discussion of Experiment
(2) Graph of Responses from Second Questionnaire
(3) Rational Statements from First and Second Questionnaires

1. We have analyzed the results received from the second questionnaire. In general, the experiment is continuing along about as we expected. This does not mean that everybody is marching in step. On the contrary, we have some people who are strongly opposed to the view of the majority. Some of their views are represented in the rationale statements in enclosure (3). When I say the experiment is going well, I mean that a consensus is emerging and that each of the answers has roughly a normal distribution about some mean value. For those who complained that they were being forced to change their answers to agree with the majority, nothing could be further from the truth. Of course, we are trying to obtain relative agreement; that's what this experiment is all about. We are trying to find agreement on values, where agreement is possible. If, however, you feel you cannot agree with the majority, feel free to say so and do so. Because ultimately, we will use a distribution of answers, every person's views will bear weight in the final answer.

2. We are a little concerned with the number of people who are not sending back their questionnaires. If we continue to lose people on each pass, we will not have enough remaining answers to do the cross comparisons which all panels indicated were of the most interest to them. As a partial stop gap we are returning this questionnaire to all those who answered the first one even if they did not respond to the second. The way this questionnaire is structured, everyone will have enough information to respond even if he did not complete the second questionnaire.

3. Enclosure (1) includes some additional discussion concerning the experiment and the instructions for filling out this questionnaire. Enclosure (2) contains a graph which summarizes the two previous questionnaires, and also serves as the answer sheet for this one. Enclosure (3) includes excerpted rationale statements from both the first and second questionnaires. The selection of statements was made by picking examples of statements which highlighted the important points of discussion.

Subj: DELPHI Determination of Utility; third questionnaire

4. Please return responses as rapidly as possible. We hope to use the results of this experiment, when completed, to meet a deadline of January 1974 as levied by the Chief of Naval Personnel.

R. K. LEHTO
SPECIAL ASSISTANT FOR
ENLISTED FORCE ANALYSIS

ADDITIONAL DISCUSSION OF EXPERIMENT

General Comment:

This particular questionnaire will deal primarily with the utility of the average man at each paygrade. This does not mean we are abandoning the average progressor concept. We will return to it on the fourth and last iteration.

Enclosure (2) is a graph of the average responses from your panel translated into graphic form. The information from Section B which asked for the year reaching peak value, the year to which that value was maintained, and the value of the 30th year was used to set the shape of each paygrade curve at the top and the right hand side. The information from Section D, on DPPO's, was used to set the shape of the left hand side of each curve. The height of each paygrade curve was determined by your answers to Section C where we asked specific paygrade values by percentage. We have abandoned the data on paygrades E1 and E2 because it was obvious from the first two questionnaires that no meaningful consensus was developing.

To repeat then, enclosure (2) is a graph which represents the sum of most of the answers you provided in the first two questionnaires. The purpose of this questionnaire is to permit you to evaluate the results of your work when presented in a different way. In other words, here is your chance to disagree with the way things are turning out. Remember, each line of the graph, labeled E3, E4, etc. represents the utility of an average man at that paygrade at any given point in time in a thirty year career.

Graphic Representation of Information Obtained:

Most of your responses to this questionnaire can be indicated by writing or drawing right on the graph itself in enclosure (2). If you want to make further comment use the back of enclosure (2) or attach extra sheets. If the curves in enclosure (2) do not agree with your views, redraw the curves to suit yourself. It is unnecessary to use straight lines. If curved lines express your views, use them. We will extract the data from the graphs based on where you redraw them. In those portions of the curves where you did not redraw the curves we will assume you agree with the results in that portion.

I believe that the three key grades in this experiment are E3, E5, and E7. If you want to simplify your task and concentrate on these three paygrades, check the box "Three Paygrade Option" on the graph and confine your answers to paygrades E3, E5, and E7.

First examine the flat tops of the curves. These bars or lines on the top represent the period of time that the average man is at peak effectiveness in that paygrade. Even more importantly the height of the line above

zero on the graph represents that paygrade's utility in reference to all other paygrades. Consider the following questions and then redraw the graph as you see fit.

> Does each of the flat, top lines start and end at about the right year? Does the length of the flat, top line seem to reflect the length of time a man is at maximum effectiveness? Are some of the lines too close together or too far apart?

Consider now the right hand side of the curves (the decline after passing peak utility). Again redraw the curves if you wish based on your views and the following considerations.

> Does the average man lose effectiveness faster than this or slower? Notice the amount of overlap. An old E6 can be worth less than a young E5 as currently expressed by the graphs. Do you think this is so? Should the overlap be more or less?

Consider now the left hand side of the curves (the rise from zero years to peak utility). Again, redraw the lines if you wish.

> Should these very young (in terms of military experience) people be worth more or less than shown? Is there too much or too little spacing between the paygrades? Note the overlap on this side. In some cases a DPPO E9 is worth less than an E5 who "grew up with the system." Is this reasonable?

Additional Information from this Questionnaire:

After completing this step you should have a marked up graph which reflects your adjustments to information we currently have. If everything is tracking so far the curves can be interpreted as the change in utility of the average man by paygrade. If this is the case, then it follows, by definition, that the average man, who has just been advanced to grade, lies somewhere on the line for that grade. This is the only new piece of information we require on this pass. Place an X on each line (E3, E5, E7 if you selected that option) at the point you think represents the utility of the average man advancing to that paygrade. For example, considering the E5's, where on the E5 line is the man who just got advanced to E5? Repeat this for each other paygrade you are considering.

Comments and Suggestions:

Finally, make any comments you wish, put your name and address on the graph and send just the graph and any attached comment sheets back in the enclosed envelope.

DELPHI II-2

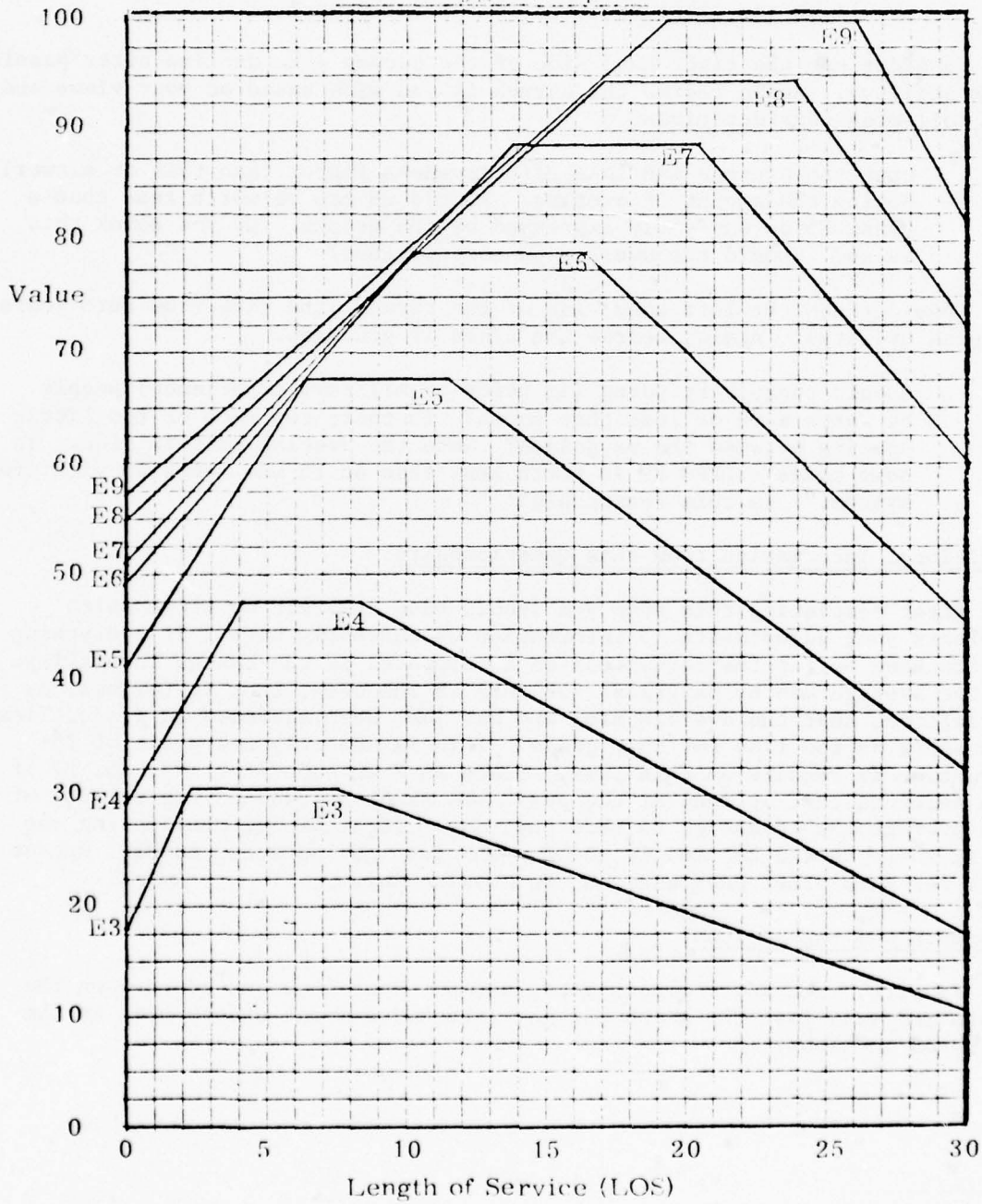
Average Results from Panel # 1

NAME _____ RATE/RANK _____

MAILING ADDRESS _____

GRAPH OF RESPONSES FROM SECOND QUESTIONNAIRE

Three Paygrade Option



Enclosure (2)

RATIONAL STATEMENTS FROM FIRST AND SECOND QUESTIONNAIRES

The following is a summary of comments from all panels. The comments deal mainly with the shape of the paygrade curves and may or may not affect your answers. Before you are swayed by these comments, remember, these are comments which support outliers. The curves represent the panel average and therefore, they represent the "implied comments" from the majority.

1. The DPPO question was used to determine the initial value of the paygrades. Remember, the DPPO is recruited based only on his technical skills gained from non-Navy sources, but he will be required to fill a billet at his paygrade which includes all functions of that paygrade. Although no large statistical differences were noted, the following arguments were given in support of answers:

a. One argument says the lower paygrade values should be higher because it does not take long to teach a civilian to swab or polish bright work. Also a high school graduate with some trade school training could make an effective E4 or E5 if he was not required to perform military duties. (The point is--he will be required to perform military duties and this will reflect in his value of the Navy.)

b. Some argue that the senior petty officer has to have skills which can only be obtained within the Navy, i.e., Naval leadership, career counselor, in depth background information, military bearing and familiarity with the "Navy way." Others argue that E8 and E9 are basically administrative and middle management positions and these traits can be developed outside the Navy with little or no difference in value.

2. For the flat portion of the paygrade curves, the maximum value was determined from question 'C' in which a paygrade value relation was requested; and the length and LOS placement were determined from question 'B' using the "Maximum Year," the year maximum value was attained, as the begin point and the "Maintain Year," the year the man will maintain maximum value, as the point. Support for maximum value follow:

a. A panelist, whose paygrade value for E6 and below averaged 13 points lower than the panel's average, argues that the value should be lower for E4 and below and higher at E7 and above. He says the greatest value step should come between E5 and E6 and most change in value (perhaps 70% or more) occurs between E4 and E7. Other panelists place E4 value as high as 70% leaving relatively little value differential for the higher paygrades.

b. One panelist argues that a person reaches 50% of his max value before seven years LOS but that an E7 maximum value is only 70%. He argues that since a distinction is made for E8 and E9 billet writing then there should be a greater value differential for these paygrades. Another argument says there is no value differential between the average E7 and E9.

c. One panelist considers that E7 is the most valuable paygrade and not E9. He argues that the E8's and E9's are generally in administrator or instructor billets ashore and that E8's and E9's at sea in non-technical billets, i.e., PMS coordinator, CMAA's, career counselor, etc. They are divorced from the rating in which their value was obtained. He says that the E7 has the ideal balance of technical ability and administrative knowledge which makes E7 the most valuable paygrade. (Should the average E7 be paid more than the average E8 or E9?)

3. There is some disagreement with the value a man has if he remains at a lower paygrade till his 30th year. The arguments follow:

a. The man who stays in the Navy at a low paygrade for 30 years is the "professional seaman" and is satisfied with his position, therefore, maintains a very high, if not 100 percent of his maximum value.

b. The lower paygrade values drop too low. The skills required for the lower paygrades are not significantly degraded over time thus value remains high. Even accounting for lost motivation and limited ability the value of a man in the lower paygrades, E3-E5, would not fall lower than 50% of his maximum value.

c. One panelist feels that the lower paygrades E3-E5 are more of a problem than they are worth. In fact, at the 20th year and before they present similar problems e.g., they feel that they rate certain privileges accorded only to their seniors in grade solely due to their time in the service; they generally have severe monetary problems; their self image is poor which is usually accompanied by other psychological hangups; to mention only a few problems. An E3 would fall into this same pit by the 12th year.

d. The E7 who remains more than a few years past the time he could retire drops to 30% of his maximum value. The drop occurs from the 25th to 30th year and is caused by the fact that since he does not advance he is just staying around for security; he does not keep up with his rate and he resists new programs. This is a much larger drop than any other paygrade, including E8 or E9.

4. Tabs A, B, and C are Tables and graphs submitted by individual panelists. They are included as additional information that may introduce a different way of considering utility, and assist in answering this questionnaire.

For item C, I have included two columns as shown in Figure 1. Column A represents as originally stated, the maximum value of a man at a particular paygrade compared to an E9 e.g., approximately 6 E2's would have the same value as an E9, or 2 E4's at their maximum value would be worth one E9. Column B has the percentage of maximum value that an individual contributes as he rises up through the ranks to E9, considering E9 as 100% e.g., at the E6 level a man has contributed 50% of his worth.

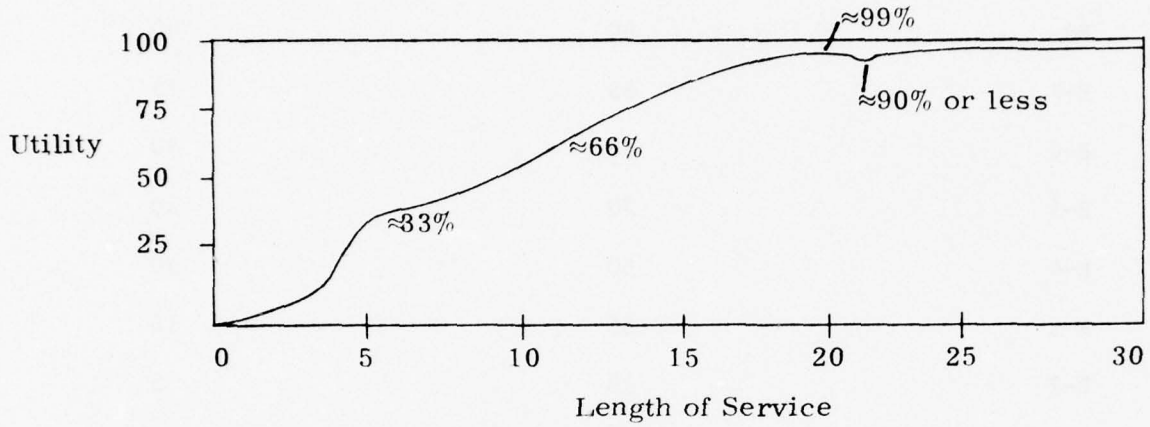
PG	VALUE (A)	VALUE (B)
E-9	100	100
E8	90	80
E-7	85	75
E-6	80	50
E-5	70	30
E-4	50	20
E-3	35	10
E-2	15	5
E-1	2	2

Figure 1. Value at a paygrade compared to E9

TAB B to Encl 3

Rationale Statements from First and Second Questionnaire

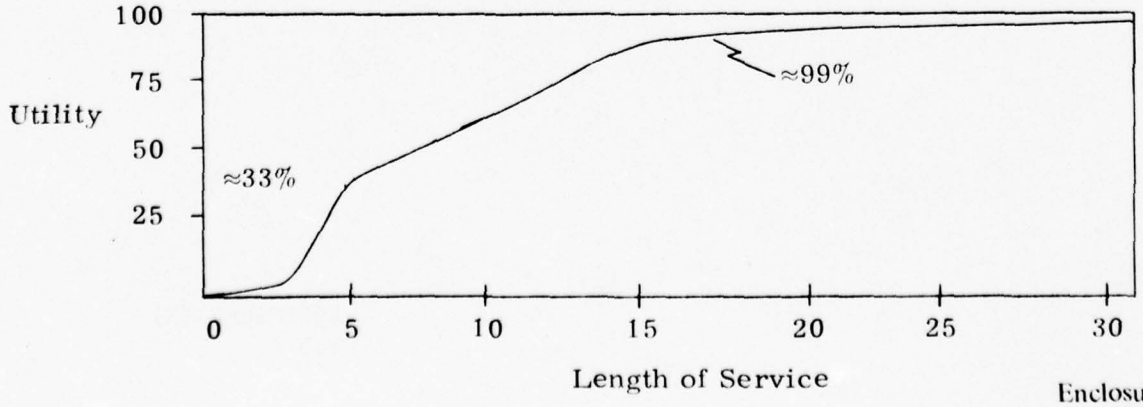
GROUP UTILITY CURVE



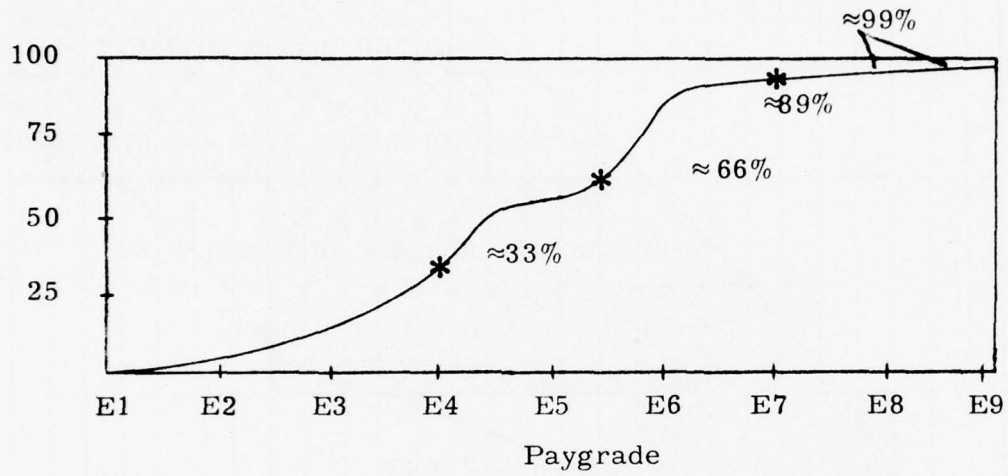
Note:

1. This chart is more reflective of the average individual in each year of service rather than the individual's progression thru service experience. (See next chart for individual progression using the study's criteria.)
2. Change in slope @ 4-5 yrs reflects separation and short timers--perhaps "dropoff" should be even more exaggerated.
3. "Drop-off" 18-20 yrs reflects retirees and short timers.
4. Max "utils" occurs ≈ 17 yrs, but approaches 100 after 20 and thru 30+ yrs. Effectively, the individual maintains a nearly constant "util" from 17 yrs until 30+ yrs.

INDIVIDUAL UTILITY CURVE



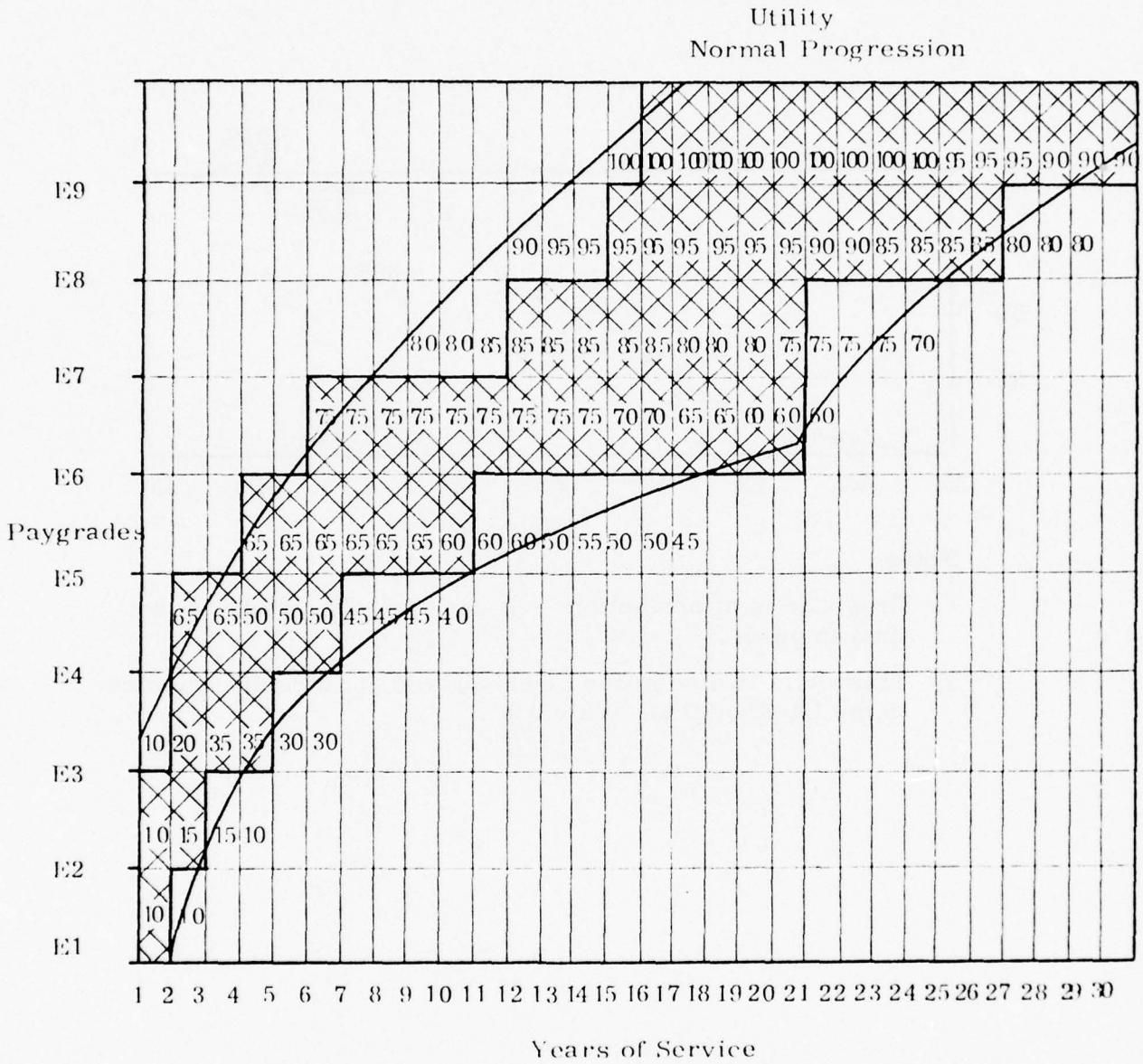
UTILITY BY PAYGRADE



Notes

1. Paygrade is at promotion -- it does not accurately reflect time in grade.

2. This chart is also group oriented, and not directly oriented to the E1-E9, 30 yr. individual.



Utility by Paygrade by Length of Service

Pers-2&211/bmd
Ser 1077/73
30 Nov 73

MEMORANDUM FOR PARTICIPANTS IN DELPHI EXPERIMENT

Subj: DELPHI Determination of Utility; clarification on Third Questionnaire

Ref: (a) Pers-2x memo Pers-2x/mmo ser 1010/73 of 12 NOV 73

Encl: (1) Graph of Responses from Second Experiment

1. Early responses received from the third questionnaire indicate we may have a problem. The only "new" information required from this pass, and therefore the most important, has been overlooked by some participants. Without this additional information, the third questionnaire will be much reduced in value; therefore, the applicable portion of the third questionnaire is being repeated here:

Additional Information from This Questionnaire:

"After completing this step you should have a marked up graph which reflects your adjustments to information we currently have. If everything is tracking so far the curves can be interpreted as the change in utility of the average man by paygrade. If this is the case, then it follows, by definition, that the average man, who has just been advanced to grade, lies somewhere on the line for that grade. This is the only new piece of information we require on this pass. Place an X on each line (E3, E5, E7 if you selected that option) at the point you think represents the utility of the average man advancing to that paygrade. For example, considering the E5's, where on the E5 line is the man who just got advanced to E5? Repeat this for each other paygrade you are considering."

In addition, another copy of the graph from reference (a) is included as enclosure (1).

2. If you have already mailed your response to the third questionnaire with the "additional information" from the paragraph quoted above please disregard this memo. If not, we urge you to complete the third questionnaire with all information and return promptly so as to avoid the holiday mailing crunch. As stated before, we hope to use this to meet a January 1974 deadline. If you have already returned

Sub): DELPHI Determination of Utility; clarification on Third Questionnaire

your questionnaire and did not provide the information requested above, please indicate your responses on enclosure (1) and return.

R. K. Lehto

R. K. LEHTO

Delphi II, Round 4, Questionnaire

Pers-2x/mmo
Ser 317/74
March 25 1974

MEMORANDUM FOR PARTICIPANTS IN DELPHI EXPERIMENT

Subj: DELPHI Determination of Utility; last questionnaire

Encl: (1) Graph of Results from Third Questionnaire
(2) Smoothed Graph of Results
(3) Additional Information Required

1. This questionnarie completes the DELPHI experiment we began some time ago. Those of you who are still with us deserve our thanks for your time and consideration. In addition, I think you can take a good deal of self satisfaction in having completed (after this questionnaire) a difficult series, requiring thought and time, and in having made a very significant contribution to the long range planning capabilities of the Chief of Naval Personnel.

2. Reviewing briefly the results obtained so far in the experiment we find that the present panels have reconfirmed, in a more refined and useful manner, what we already suspected about the concept of the average progressor. In addition, you have made contributions to what we believed about the relative value levels of the average man at each paygrade. Most significantly, you have developed and described for us the utility of men by paygrade as they progress through their career. This factor we knew little about before, and in this area my own personal biases were wrong. As a result of your efforts we have been able to correct some previous assumptions which could have caused us considerable difficulties in the future.

3. Enclosure (1) is the graph which you saw on the last pass, corrected for the changes which people made on the last pass. As nearly as we can tell this represents the best estimate we will be able to obtain from this experiment, of the variation of utility by paygrade and LOS. The graph, as you remember represents only the plotting of 4 points for each paygrade. All authorities agree that utility growth over time does not change linearly but rather changes continually in smooth curved forms. Some of you recognized this when you corrected your graphs on the last pass and not only adjusted points but also hand smoothed the lines. What we have done is taken the four points you have given us and fitted, by computer, a smooth curve which describes these points in a continuous curve instead of a series

of straight lines. The result of this curve fitting is shown in enclosure (2). The picture in enclosure (2) is the result of the weighted average of all panels combined and is provided here to show you the final results.

4. Enclosure (3) is the material required on this pass and requires comparisons of the average man with men in specific ratings. It is the final, and one of the more important pieces of information, we need to complete the experiment. Give it your close attention. This is your chance to express the point most of the people raised in briefings. "How do we handle the differences between ratings?"

5. The final results of the experiment will be available about a month from now, depending on how fast the questionnaires come in. If enough of you are interested, we will come down to Norfolk, probably late in April, to brief you on the results of your efforts, how you compared with previous experiments, and most importantly, how your work will be used in the future. The briefing would probably be conducted at one central location, probably NOB Norfolk, rather than the separate briefings previously conducted. If you are interested in such a briefing, there is a place on the answer sheet to so indicate.

6. Again, thanks for your time, efforts, and cooperation. You have made a contribution far greater than many of you realize.

R. K. LEHTO
SPECIAL ASSISTANT FOR
ENLISTED FORCE ANALYSIS

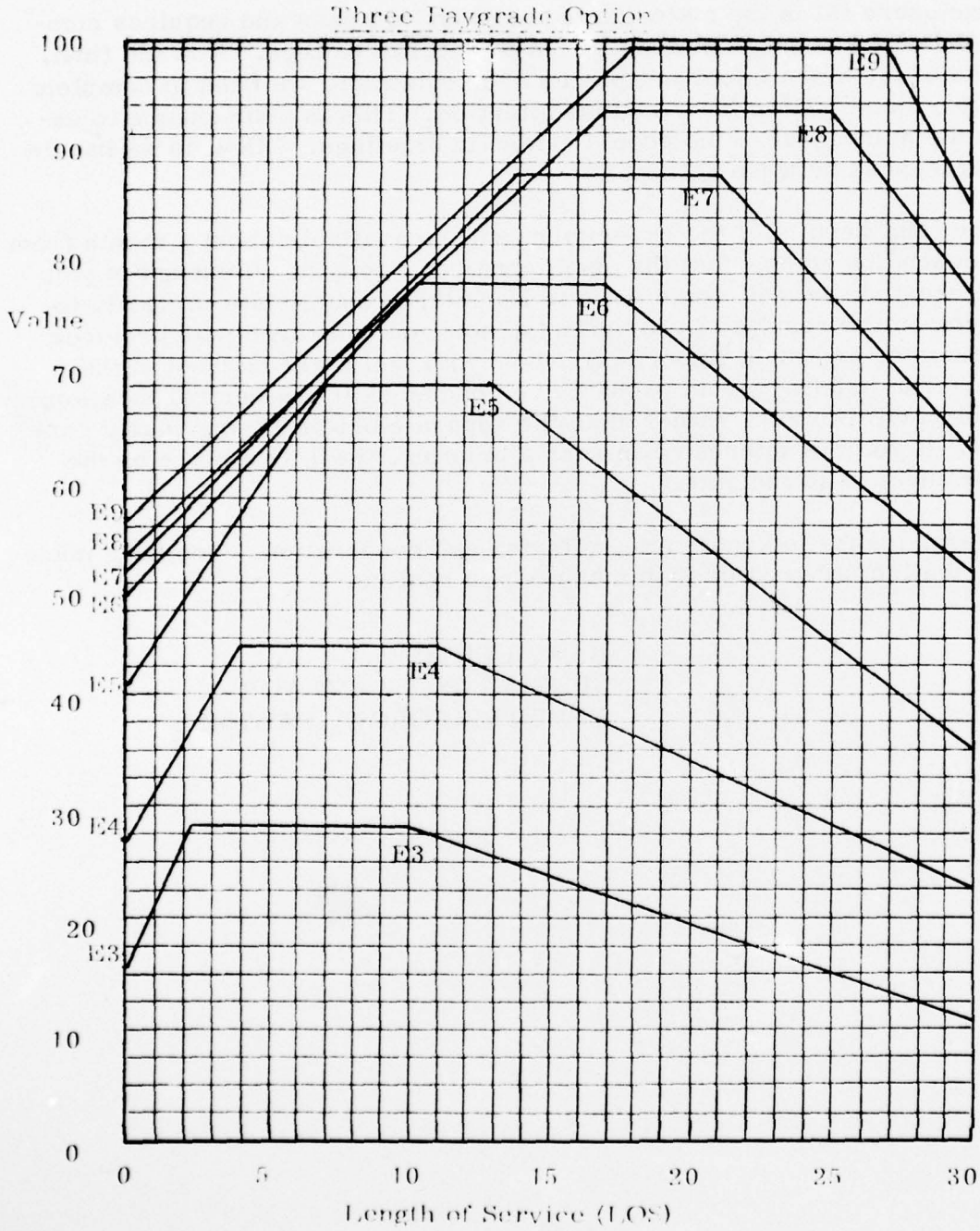
ENCLOSURE 2

Average Results from Enclosure 1

NAME _____ DATE/RANK _____

MAILING ADDRESS _____

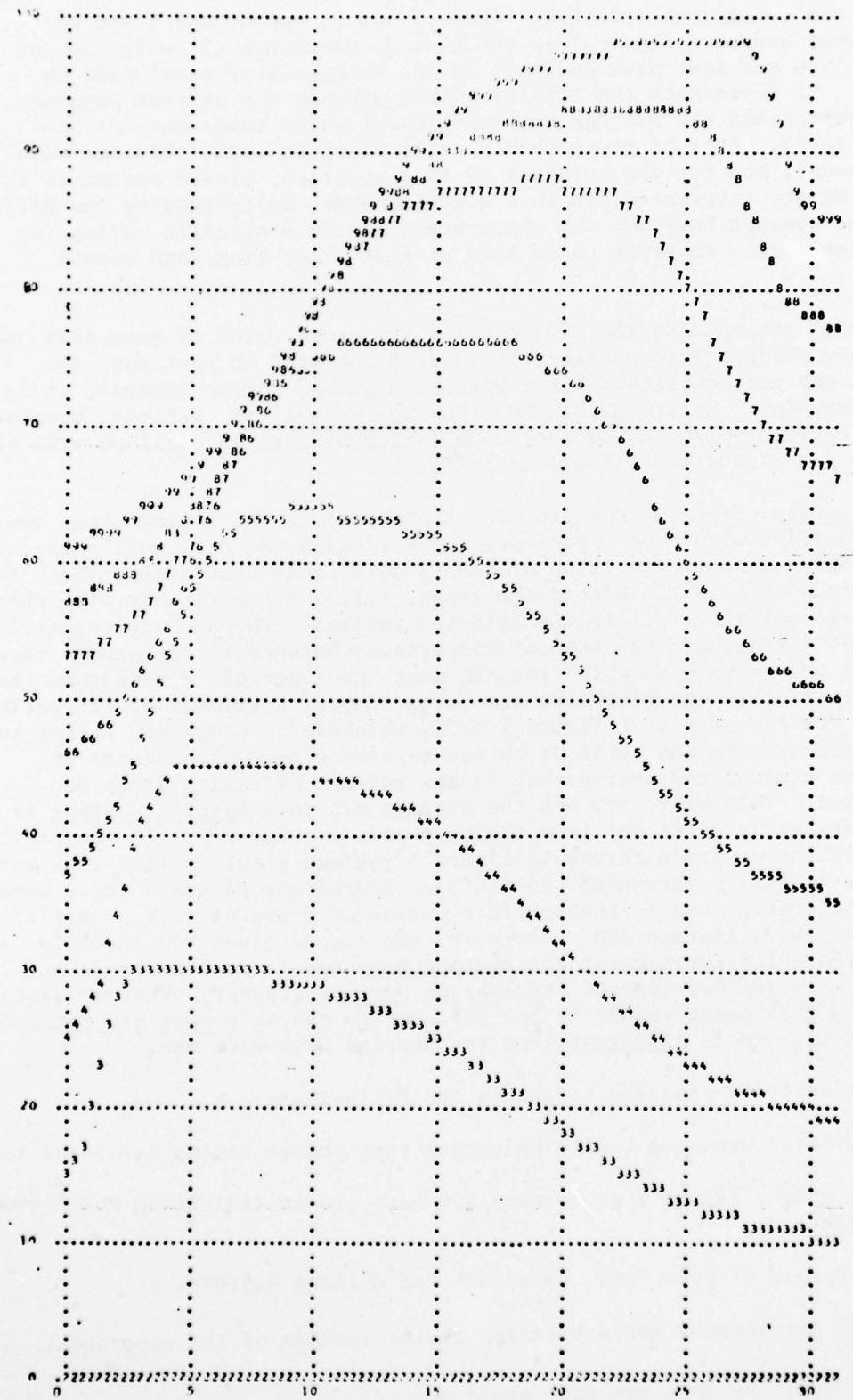
GRAPH OF RESULTS FROM THIRD QUESTIONNAIRE



Enclosure (1)

SMOOTHED GRAPH OF RESULTS

Utility Curves



Enclosure (2)

ADDITIONAL INFORMATION REQUIRED

1. There are two graphs attached, Figure 1 and 2, one of which you will need for your answer. Figure 1 is the same as enclosure (1) which is the same graph you saw last pass modified by the changes your panel made on that pass. It represents the utility of the average man at each paygrade. Figure 2 represents the average Navy progressor as he moves through his career up to E9. Some of you probably still disagree with this portrayal of the concept, but for the purposes of this question, please assume it is correct. We are interested, in this questionnaire, in evaluating the differences between the average Navy man and the average man in a specific rating (or group of ratings). In order to do this we must start from some common baseline.

2. The table attached is the DOD grouping structure which is generally used to aggregate ratings into categories based on the kind of work they do. Again, you may not completely agree with each group, but in general, it is a useful grouping. We are using DOD groupings as well as ratings, because, if we use ratings only, the data on each rating will be so small we will not be able to get a good statistical analysis.

3. Instructions: From the DOD grouping table, select the rating group you are most familiar with from experience and for which you feel most competent to make judgments about the value of people working in that group. Mark the selected group with an X. Within the group, select those ratings with which you are most familiar. Circle the selected ratings. Choose only one rating group and do not attempt to make any comparisons between rating groups except to identify the group with which you are most knowledgeable. We assume that your answers to this questionnaire are based on your knowledge of the ratings selected. Now choose either figure 1 or 2, whichever concept you prefer to work with and draw in the curve or curves representing your estimate of utility over time of the average man in the ratings or rating group you have selected. This will show how the average man in a specific rating or group of ratings is different from the Navy-wide average man. If you prefer working with the paygrade curves in figure 1 you may simplify your task and concentrate on only paygrades E3, E5 and E7. Redraw any paygrade curve where you feel the average man in the specific rating or group of ratings differs from the Navy-wide average man. Remember, the graphs given you show: in figure 1, the value overtime of the average Navy man at each paygrade and in figure 2, the value overtime of the average Navy progressor. What we want to know from this questionnair is how the average man in a specific rating or group of ratings is different from the average Navy-wide man.

4. Use the enclosed envelope to return the following:

a. DOD Skill Grouping table indicating your chosen rating group and ratings.

b. The graph, figure 1 or 2, that you have chosen indicating any changes you have made.

c. An update of your Navy, Rate/Rank and Mailing Address.

d. Your perferences for a briefing on the results of the experiment.

Thanks again for the help you have given us.

DOD SKILL GROUPING

INFANTRY GUN CREW AND SEAMANSHIP SPECIALISTS	ELECTRONIC EQUIPMENT REPAIRMEN	COMMUNICATIONS AND INTELLIGENCE SPECIALISTS	MEDICAL AND DENTAL SPECIALISTS	OTHER TECHNICAL AND ALLIED SPECIALISTS
BM	ST	SM	HM	DM
QM	TM	OS	DT	MU
	FT	CTT		EA
	MT	CTR		AG
	ET	CTI		PH
	DS	AW		
	CTM	AC		
	AV	PT		
	AT	RM		
	AX	EW		
	AQ			
	TD			
	OT			

ADMINISTRATIVE SPECIALISTS AND CLERKS	ELECTRICAL/ MECHANICAL EQUIPMENT REPAIRMEN		CRAFTMAN	SERVICE AND SUPPLY HANDLERS
CTA	GM	BR	LI	CS
CTO	PI	IC	MR	SH
YN	OM	CM	HT	SD
LN	MM	AD	PM	
PN	BT	AB	ML	
DP	EM	AM	CU	
SK	EQ	AS	CE	
DK	AF		EO	
JO	AO		BU	
PC	AE		SW	
AK	PR		UT	
AZ	MN			
MA	IM			
NC	EN			

CONSOLIDATION RATIONALE:

1. GMG placed in DOD Occupational Area 6 with GMM and GMT due to the many similarities in qualifications and compression to GM at paygrade E8 and E9.
2. MASTER AT ARMS (MA) established 1 August 1973.
3. Navy Counselor (NC) established 1 August 1973.

Table (1)

DELPHI II -3, PANEL 1

AVG NAVY MAN AT EACH PAYGRADE

NAME _____ RATE/RANK _____

ADDRESS _____

Would you attend a briefing on the results? Yes _____ No _____

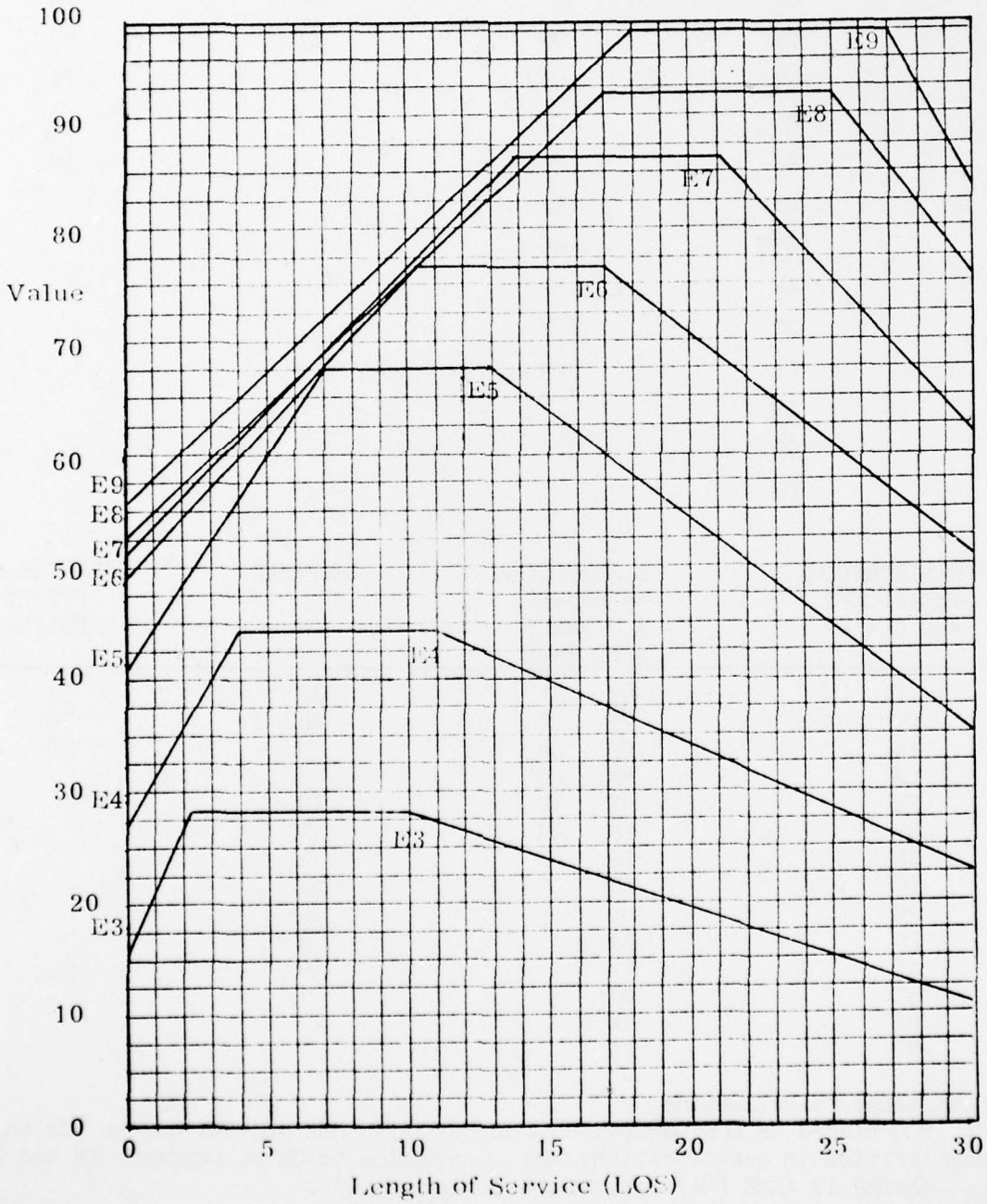


Figure (1)

DELPHI II - 3

AVERAGE NAVY PROGRESSOR

NAME_____ RATE/ RANK_____

ADDRESS_____

Would you attend a briefing on the results? Yes_____ No_____

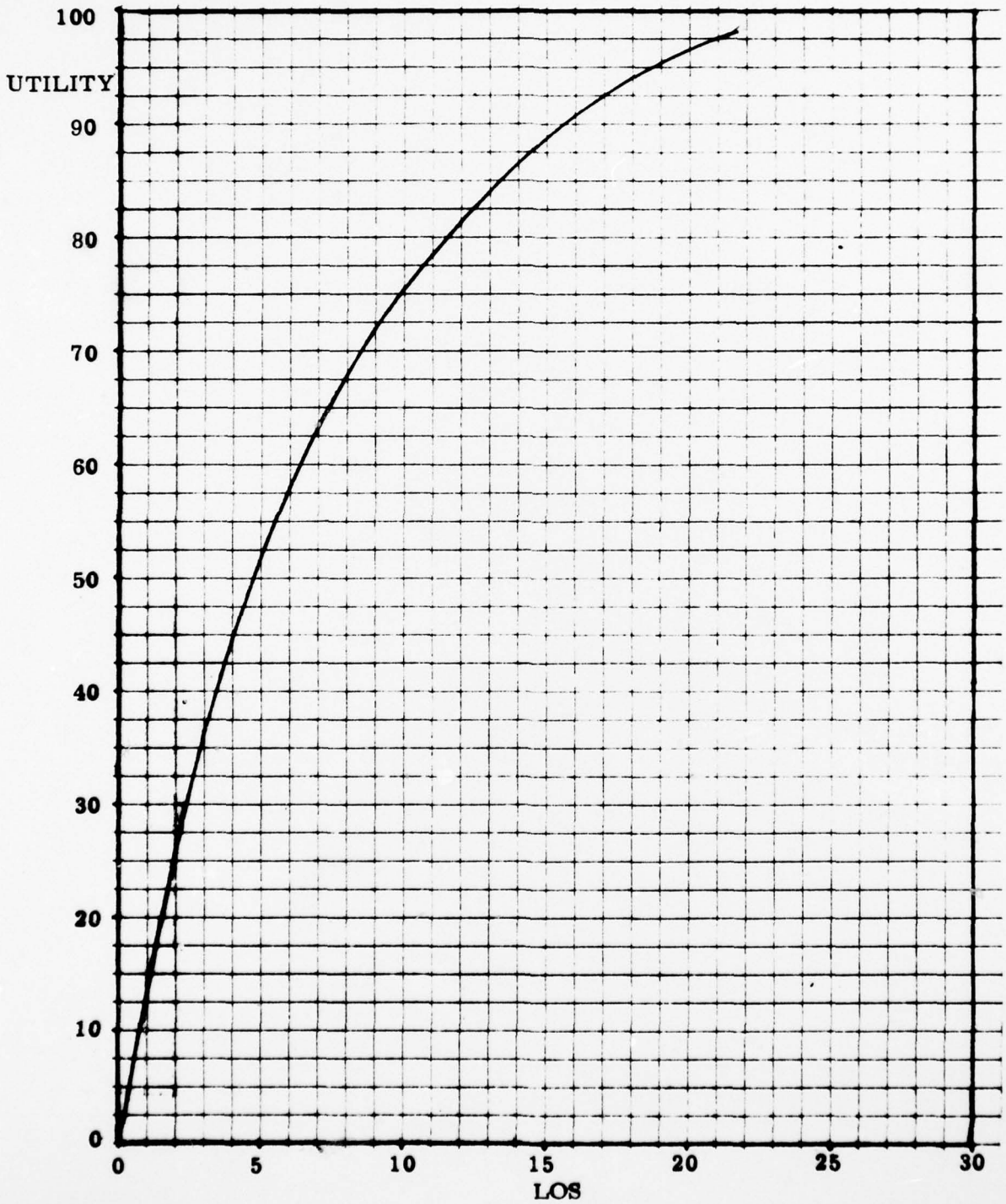


Figure (2)

APPENDIX B

DELPHI II SUMMARY STATISTICS

Delphi II, Round 1

	All Panels			Panel 1			Panel 2			Panel 3		
	Q_1	μ	Q_3	Q_1	μ	Q_3	Q_1	μ	Q_3	Q_1	μ	Q_3
Average Progressor												
• LOS reaching maximum value	12	15	18	12	14	15	12	16	18	12	16	18
• LOS maintaining maximum value	20	24	28	18	23	28	20	24	28	24	25	28
• Value at LOS 30	65	73	80	70	69	80	65	78	90	65	72	80
• Value at LOS 4	25	36	40	30	39	45	25	35	40	25	34	40
• LOS at 50% of maximum value	6	7	8	5	7	8	6	7	8	6	7	8
Paygrade E-3												
• LOS reaching maximum value	2	2	3	2	3	3	2	3	3	2	3	3
• LOS maintaining maximum value	4	7	6	3	8	6	4	7	6	4	6	7
• Value at LOS 30	0	24	30	0	23	30	0	26	30	10	21	30
Paygrade E-4												
• LOS reaching maximum value	3	4	5	3	4	5	3	4	5	3	4	4
• LOS maintaining maximum value	6	9	10	5	9	9	6	9	10	6	8	10
• Value at LOS 30	10	29	40	10	26	30	15	33	45	10	27	40
Paygrade E-5												
• LOS reaching maximum value	5	7	8	5	7	7	5	7	8	5	6	7
• LOS maintaining maximum value	9	12	14	9	12	14	9	12	12	10	12	14
• Value at LOS 30	30	47	70	30	43	60	30	53	70	25	45	60
Paygrade E-6												
• LOS reaching maximum value	8	10	12	7	10	12	8	10	12	8	10	12
• LOS maintaining maximum value	14	17	20	12	16	20	15	18	20	16	17	20
• Value at LOS 30	50	61	75	50	59	75	50	66	80	50	60	75
Paygrade E-7												
• LOS reaching maximum value	12	14	16	12	13	15	13	16	18	12	14	16
• LOS maintaining maximum value	19	21	25	17	20	23	20	23	25	19	22	25
• Value at LOS 30	65	73	80	60	67	80	75	77	90	70	75	80
Paygrade E-8												
• LOS reaching maximum value	15	17	20	15	16	18	16	19	20	16	18	20
• LOS maintaining maximum value	20	24	27	20	22	26	23	25	28	22	25	30
• Value at LOS 30	75	79	90	70	75	80	75	82	90	75	81	90
Paygrade E-9												
• LOS reaching maximum value	17	20	22	16	18	20	18	21	24	19	21	24
• LOS maintaining maximum value	24	26	29	22	24	28	24	27	30	24	27	30
• Value at LOS 30	75	80	95	70	73	85	80	88	95	75	83	95
Maximum Value												
• E-1	5	15	20	5	14	20	5	12	20	10	20	20
• E-2	10	22	25	10	22	30	10	18	25	15	27	30
• E-3	20	32	40	20	33	40	20	30	40	25	35	40
• E-4	40	48	50	30	49	65	30	44	50	40	50	55
• E-5	50	64	75	50	69	80	50	59	70	55	63	75
• E-6	70	77	85	70	79	90	65	76	85	70	77	85
• E-7	85	89	95	80	89	95	85	88	90	85	89	95
• E-8	90	94	100	90	94	100	90	94	100	90	95	100
• E-9	100	99	100	100	100	100	100	99	100	100	99	100
Percent of Maximum Value Upon Entrance (LOS 0)												
• E-2	10	42	75	10	47	90	5	23	30	25	53	85
• E-3	20	45	70	15	50	90	15	30	40	25	52	80
• E-4	30	50	75	33	57	90	30	40	50	40	51	70
• E-5	40	55	70	45	59	75	40	49	60	40	54	70
• E-6	45	55	70	50	58	70	50	58	65	40	50	65
• E-7	40	55	70	40	54	65	30	62	70	30	50	60
• E-8	40	56	75	40	56	75	50	64	75	25	49	70
• E-9	40	58	80	45	56	75	50	60	80	35	50	80

Delphi II, Round 2

	All Panels			Panel 1			Panel 2			Panel 3		
	Q_1	μ	Q_3	Q_1	μ	Q_3	Q_1	μ	Q_3	Q_1	μ	Q_3
Average Progressor												
• LOS reaching maximum value	14	15	16	12	14	15	14	15	16	16	18	18
• LOS maintaining maximum value	22	24	26	19	24	25	24	25	26	24	25	26
• Value at LOS 30	70	75	80	75	75	75	80	80	80	60	75	80
• Value at LOS 4	30	36	40	30	40	45	30	35	40	25	30	40
• LOS at 50% of maximum value	6	7	8	5	6	7	6	6	7	8	8	8
Paygrade E-3												
• LOS reaching maximum value	2	2	3	2	2	3	2	3	3	2	2	3
• LOS maintaining maximum value	4	4	5	4	4	6	4	5	6	4	4	5
• Value at LOS 30	20	26	30	10	20	60	20	25	30	10	20	25
Paygrade E-4												
• LOS reaching maximum value	3	4	5	4	4	5	4	4	5	4	4	4
• LOS maintaining maximum value	6	8	9	6	7	8	7	8	9	6	7	8
• Value at LOS 30	25	32	40	25	30	30	30	35	40	20	30	30
Paygrade E-5												
• LOS reaching maximum value	6	7	8	6	7	7	7	8	8	6	6	7
• LOS maintaining maximum value	10	12	12	10	11	12	11	12	12	12	12	12
• Value at LOS 30	40	47	60	40	45	50	45	50	60	40	45	45
Paygrade E-6												
• LOS reaching maximum value	9	10	12	9	10	12	10	10	11	10	10	12
• LOS maintaining maximum value	15	17	18	15	16	18	16	18	18	16	16	19
• Value at LOS 30	55	59	70	50	55	65	60	65	70	50	55	65
Paygrade E-7												
• LOS reaching maximum value	14	15	16	12	14	15	14	16	16	14	14	16
• LOS maintaining maximum value	20	21	22	20	20	20	20	22	24	20	20	22
• Value at LOS 30	70	71	75	60	70	75	70	80	80	65	70	75
Paygrade E-8												
• LOS reaching maximum value	16	18	20	16	17	18	18	20	20	16	16	19
• LOS maintaining maximum value	23	25	26	23	24	25	25	26	27	22	25	26
• Value at LOS 30	75	[illegible]	85	70	75	80	80	85	85	75	80	85
Paygrade E-9												
• LOS reaching maximum value	19	21	22	18	19	20	21	22	22	20	22	22
• LOS maintaining maximum value	19	27	23	25	26	28	27	28	28	26	26	28
• Value at LOS 30	80	84	90	80	80	85	85	90	90	75	85	90
Maximum Value												
• E-1	10	13	15	10	10	15	10	10	15	10	15	20
• E-2	15	20	25	15	20	25	15	20	20	15	20	30
• E-3	30	30	35	30	30	35	30	30	40	25	30	35
• E-4	40	47	50	40	50	50	45	45	50	40	40	60
• E-5	60	64	70	65	70	75	55	60	60	60	60	70
• E-6	70	77	80	75	75	85	70	75	80	70	80	80
• E-7	85	88	90	85	85	90	85	90	90	85	90	90
• E-8	95	95	95	95	95	100	90	95	95	95	95	95
• E-9	100	100	100	100	100	100	100	100	100	100	100	100
Percent of Maximum Value Upon Entrance (LOS 0)												
• E-2	25	49	75	35	55	85	20	20	25	50	65	100
• E-3	30	51	65	40	50	85	25	25	30	50	50	80
• E-4	40	53	60	50	55	80	35	40	40	50	50	70
• E-5	50	57	65	50	55	70	45	50	50	45	50	75
• E-6	50	57	60	55	60	70	50	60	60	45	50	60
• E-7	50	56	60	50	50	60	60	60	65	30	50	60
• E-8	50	57	65	50	35	65	60	60	70	30	50	65
• E-9	50	58	70	50	55	70	60	65	75	20	50	65

Delphi II, Round 3

	All Panels		Panel 1	Panel 2	Panel 3
	μ	95% Conf. Interval	μ	μ	μ
Paygrade E-3					
• Value at LOS 0	15	13.2-16.4	17	9	20
• Maximum value	31	30.2-32.4	30	32	32
• LOS reaching maximum	3	2.4- 2.8	3	3	2
• LOS maintaining maximum	7	5.5- 9.1	10	5	6
• Value at LOS 30	10	7.4-12.4	12	8	10
Paygrade E-4					
• Value at LOS 0	25	23.0-26.4	30	18	27
• Maximum value	47	45.7-47.5	49	44	46
• LOS reaching maximum	4	4.1- 4.5	5	4	4
• LOS maintaining maximum	10	8.3-10.9	11	9	8
• Value at LOS 30	19	15.8-21.6	23	15	18
Paygrade E-5					
• Value at LOS 0	37	34.3-38.9	43	29	37
• Maximum value	65	62.9-66.5	70	62	62
• LOS reaching maximum	7	6.8- 7.4	7	8	7
• LOS maintaining maximum	13	12.4-14.2	14	13	12
• Value at LOS 30	35	30.4-39.0	40	30	33
Paygrade E-6					
• Value at LOS 0	45	42.8-47.2	50	44	39
• Maximum value	77	76.2-78.6	80	76	76
• LOS reaching maximum	10	10.2-10.6	11	10	10
• LOS maintaining maximum	18	17.5-18.7	18	18	18
• Value at LOS 30	50	45.3-54.7	53	48	48
Paygrade E-7					
• Value at LOS 0	51	48.4-53.9	54	55	42
• Maximum value	89	87.8-89.2	89	88	88
• LOS reaching maximum	14	14.0-14.8	14	15	15
• LOS maintaining maximum	22	21.1-22.3	21	22	22
• Value at LOS 30	66	61.7-71.1	65	68	67
Paygrade E-8					
• Value at LOS 0	56	52.8-58.2	57	60	47
• Maximum value	94	93.3-94.5	95	92	95
• LOS reaching maximum	17	16.9-17.9	17	19	17
• LOS maintaining maximum	25	24.5-25.7	25	26	24
• Value at LOS 30	78	73.7-81.3	77	78	78
Paygrade E-9					
• Value at LOS 0	60	56.6-62.4	60	66	50
• Maximum value	99	98.7-99.5	100	98	99
• LOS reaching maximum	20	19.1-20.5	19	21	21
• LOS maintaining maximum	27	26.9-27.7	27	28	27
• Value at LOS 30	86	81.7-89.5	84	88	85

Comparison of Delphi II, Round 4, Results
with Delphi II, Round 3, Results (All Panels)

	Delphi II, round 3	Delphi II, round 4
Paygrade E-3		
• Value at LOS 0	15	15
• Maximum value	31	33
• LOS reaching maximum	3	3
• LOS maintaining maximum	7	7
• Value at LOS 30	10	10
Paygrade E-5		
• Value at LOS 0	37	37
• Maximum value	65	65
• LOS reaching maximum	7	7
• LOS maintaining maximum	13	14
• Value at LOS 30	35	33 (-4%)
Paygrade E-7		
• Value at LOS 0	51	51
• Maximum value	89	89
• LOS reaching maximum	14	14
• LOS maintaining maximum	22	22
• Value at LOS 30	66	69 (+3.3%)

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